EVERYBODY'S ENCYCLOPEDIA

FOR EVERY DAY REFERENCE

FOR HOME, SCHOOL & OFFICE

12-25-07

Hugo Bruetzke
Campbellsport
1907 Wis

Every Day Questions

In the upper illustration is shown a child asking questions of its parent to which no heed is given. This is doing a child a great injustice, but it is equally wrong to give incorrect answers to children's questions, because the mind of a child absorbs information and it is therefore important that the information obtained is accurate. In the lower picture we find the parent heeding and answering the questions of the children and thereby imparting information that may prove beneficial in after life. The EVERY DAY DICTIONARY gives interesting and accurate information on all common things, and its use will enable persons to give information such as is called for in every day life.

EVERYBODY'S ENCYCLOPEDIA
For Every Day Reference

A Compendium of Necessary Information

—FOR—

HOME, SCHOOL AND OFFICE

COMPRISING

EVERY DAY REFERENCE DICTIONARY
Giving in Simple Language Accurate Information on All Subjects.
EVERY DAY HISTORICAL DICTIONARY
Of the World's Great Men and Women from Moses to Roosevelt.
EVERY DAY BUSINESS GUIDE
Of Modern Methods and Forms for Doing Business.
EVERY DAY MECHANICS FOR MAN AND BOY
Giving Simple Plans and Practical Receipts for Doing Useful and Profitable Work.
EVERY DAY ETIQUETTE AND LETTER WRITER
The Latest Rules, Customs and Forms for Social and Business Intercourse.
EVERY DAY LAW AND LEGAL FORMS
In Practice, that Everyone Should Know.
EVERY DAY COMPENDIUM OF REMARKABLE FACTS
Of Persons and Events in the World's Annals.

Editor-in-Chief
CHARLES MORRIS
Editor of "Twentieth Century Cyclopedia," "Zell's Encyclopedia" (Revised Edition), "The
Handy Dictionary of Biography," "Thomas's Biographical Dictionary" (Revised
Edition), and many other Books of Reference. Author of numerous
Standard Works on History, Biography and Science.

Assisted by

PROF. E. C. MILLS
Expert Penman, Rochester, New York.

PROF. R. S. COLLINS
Pierce Business College, Philadelphia.

HENRY H. ALBERTSON
Associate Editor "Farm Journal," Philadelphia.

AND OTHER EMINENT SPECIALISTS.

PROFUSELY ILLUSTRATED

Entered according to Act of Congress in the year 1907 by W. E. SCULL, in the office of the Librarian of Congress, at Washington, D. C.

All Rights Reserved.

PREFACE

Success to-day comes first to those who are best prepared to take advantage of all opportunities as they arise, and to those who have the best practical education. It is the man who possesses knowledge who is able to outstrip his competitors in this age of great things, great thoughts, great inventions and great events. And it is not only necessary to have knowledge, but you must keep getting more knowledge or you will be left behind. Other men who are studying and learning how to meet difficult problems in their business and in their life will surely distance you unless you are adding to your experience and to your ability to answer new questions as they arise.

It is not possible for every person to have avenues made easy for acquiring valuable experience, nor to learn from the best living teachers of the day. To keep up with business and the progress of things we must possess the necessary means of self-help, and of these means the best are books—books of reference, of information, of ways and means, of facts and figures, and of practical illustration. But it is not everyone who has access to the great libraries of large cities, and even those who have such means of study are overwhelmed by the thousands of books which must be mastered in order to gain a comprehensive education. No man, no matter how good his memory, can keep in mind more than a small fraction of the things desirable to know. Facts are accumulating too fast for that. There are thousands of facts which the best of us cannot hope to keep in our memories ready for instant use. It is for this reason that books of reference are necessary, works in which facts of all kinds lie conveniently classified ready to find at a moment's notice.

There have been many books of reference and information published, but most of them are disappointing. They are either out of date, or they fail to tell exactly what you wish to find when you are looking for information. And most of them are not practical. They give a quantity of alleged facts which are of the least possible use to the busy man who wants to answer the everyday questions, or who wants to make one dollar do the work of two, or who wants to do a two hour job in one hour; and for the man who wants to progress, who wants to improve his ability in order to grasp opportunities when they come, there is no faithful helper ready to give him the right kind of advice at the right time.

This volume has been made for the busy practical man, for the man who is ambitious, and for the man who is up against hard questions of everyday life. This book is more than a mere reference book of facts and figures. It is a self-helper. Self-help is the best help and home instruction often the best instruction, for it has been a remarkable feature of the success of our great men that they have done their day's work where the work happened to be and then in their homes they have prepared themselves for bigger things.

So we present to the reading public this work which can be accepted with the fullest confidence, a book of ready reference on all practical subjects, a complete compendium of the knowledge and progress of the world in which we live, a treasury of information dealing with every phase of modern practical affairs.

Facts, we are often told, are stubborn things. They truly are when we call them and they will not come; when we seek them and they are not to be found; when such as we have once met hid themselves away in some obscure recess of our brains, and refuse to come forth in response to our most earnest demand. Facts are elusive and baffling things, escaping us when we most want them, playing about us just out of reach, failing to respond to whistle or call. Yet they are things we need daily; hardly an hour passes in which there is not something that we wish to know, and we seek in the cells of memory in vain. Facts are our tools in trade, the most useful and necessary implements of the man of affairs, the daily need of the mistress of the household, the steady demand of the growing boy and girl; and nothing is more useful in home and office, in school and library, than an ample compendium of the things the world wants to know, a cabinet whose door may be opened at a moment's notice and the stubbornest fact drawn triumphantly forth. All must acknowledge that such an encyclopedia is a very convenient thing to have at one's elbow—indispensable would be a better word. Such an encyclopedia we have here, a work replete with facts in the most satisfying fullness and variety, brimful of useful information suited to all tastes and needs, containing just what every one most wants, from bustling housewife to busy merchant or mechanic, from stirring schoolboy to the young lady about to be launched upon society.

OUR NEW ENCYCLOPEDIA FOR EVERY DAY REFERENCE.

In the whole world of modern books you will find nothing to take the place of this our Twentieth Century Record of Information. You will find it a genuine literary telephone. Call "Hello!" into it whenever you wish and you can depend on getting a prompt and satisfactory reply. Hundreds of wide-awake correspondents, of all times and all professions, lurk within its pages, ready to be called up at any time, always on hand and at leisure, and able to give you the best and most timely information of the day or of the ages. Here you have a true *multum in parvo*, a repertory of sifted, concentrated and digested facts, a systematic and compendious collection, containing just what everybody wants to know—the mechanic, the business man, the housewife, the man and woman of society, the writer and reader, the lover of science and inventions, the dweller in city or country, in fact, anybody who is in search of practical information on everyday matters can scarcely fail to find some answer to his demand in these well-filled pages.

You will find here not alone a time-saver, but a money saver as well, capable of paying you back annually ten times the price of the book,—not ten times its value; it must be remembered that value and price are often very different things. Are you in doubt as to the proper form to draw a check or note or some other business paper, or whether it has the proper endorsement; or do you wish to know how to close an account in your Ledger? Open to the Business Department of this book and you will find it there. Do you wish information on some legal point? You have here your own lawyer, who asks no fees for his advice. Are you a householder in a rural residence, and something has gone wrong with the plumbing, the woodwork, the furniture, or papering? Well, you can, if your time is otherwise occupied, call in carpenter, plumber, or upholsterer, and pay their bills; but if you have leisure and like exercise, you may find here just what you want to know about tools and materials and methods of work, and, if the difficulty is not a serious one, you will be able to save money and perhaps do as good a job of work as a professional mechanic. This is by no means all. You may be invited to some fashionable social function, or wish to invite some of your fashionable acquaintances to dinner or luncheon, and be in doubt about some small but essential matter of etiquette. You may wish to know how to address some important correspondent or to present a letter of introduction or recommendation. You might ask your friends to help you in your dilemma, but you do not care to confess ignorance on such matters. Nor do you wish to buy a book on etiquette for such a minor affair. Well, you have no need, you will find all you require to know here, and much other useful information about etiquette and correspondence, all fully down to date, telling how men and women should comport themselves in all the social and business exigencies of life in this new century of the world's history.

These are some of the ways in which this work may save you money. They are not all the ways. We have mentioned only a few of its departments. In a dozen ways you may find here information which otherwise you would have to pay for, and often to pay for very dearly. As already said, self-help is the best help.

Having frequently ourselves experienced the various wants above spoken of, we have prepared this encyclopedia for our own convenience as well as for that of others. The editor has sought the assistance, in its preparation of scholars and practical writers, thoroughly conversant with the topics placed in their hands, with every confidence in the trustworthy results of their labors. Throughout it has been our endeavor to make this work a *practical aid* to those who may have occasion to use it, a guide to success to those who apply to it for business purposes and a channel of important information to those who turn to its pages for help in social matters or the many other problems of modern life.

The Plan of This Book

Realizing fully that it is not sufficient to have an alphabetical treatment of a multitude of subjects, but rather an intelligent and practically complete separate handling of the various topics of useful information, we have arranged our work in the form of Departments, each embracing some broad field of affairs, and each systematically subdivided into convenient sections and paragraphs, in which the several topics under each department are clearly and succinctly handled. Thus, in the *Department of Business* an effort is made first to give a sufficient knowledge of *Language*,—the instrument of all communication,—chapters being given on the proper use of English. Then follow lessons on *Penmanship*, illustrated by valuable copy-plates; on *Banking*, *Money*, *Business Forms*, *Bookkeeping*, the ready manipulation of figures, helps in *Everyday Law*, etc. All these form trustworthy sources of reference for men in business, and the best possible assistance in training the young and the inexperienced. By diligent application and earnest study, one may obtain from these pages all the essential elements of a business education.

This is but one of numerous departments. In the field of *Practical Mechanics* will be found helps and suggestions that cannot but appeal to every one who cares to work with hands and tools, or needs to oversee the work of others. The schoolboy will require no fuller or more carefully prepared cyclopedia than we present, and persons in every field of life cannot fail to find something adapted to their special needs.

Turning from the practical to the social side of life, this will be found as fully dealt with. The pleasure of existence is largely enhanced by a recognition of the customs prevalent in polished and cultivated society, and the *Laws of Etiquette* become important to all who have to meet others in social intercourse. It will suffice to say that the treatment of this important subject is full and all-embracing. We may make passing mention, also, of the extended *Cyclopedia of General Facts*, which rounds up the work and adds enormously to its utility.

Without enumerating the other departments, all of them equally important and interesting, what we have said must suffice to show that a book like this cannot fail to prove an invaluable Household Companion, appealing to old and young alike, to the cultured and those striving for culture to both sexes and all conditions, to all, in fact, who want success in life. The merits claimed for this work are its *newness and freshness of material* its width of scope and its clear and logical arrangement. It covers a larger number of practical, every-day subjects, in an interesting and intelligent manner, than ever before attempted; it is written to meet the requirements of a manual of instruction and a handbook of reference; and it cannot fail to prove a mine of valuable information to all fortunate enough to possess it.

In conclusion, we may refer to the wealth of well-chosen illustrations, which have been prepared without regard to effort or expense, the purpose being to present the best that artistic skill could suggest and execute to supplement the printed page. Business, mechanics, etiquette, biography, etc., all furnish subjects for illustration, our constant effort having been to present a work at once useful and beautiful. In this we think all must acknowledge that we have abundantly succeeded.

THE PUBLISHERS.

TABLE OF CONTENTS

BOOK I.

EVERY DAY REFERENCE DICTIONARY

SPELLING, PRONUNCIATION, DERIVATION, AND DEFINITION OF WORDS STANDING FOR COMMON THINGS IN DAILY USE; ALPHABETICALLY ARRANGED; APPROPRIATELY ILLUSTRATED WITH NUMEROUS ENGRAVINGS 17

BOOK II.

EVERY DAY HISTORICAL DICTIONARY

DICTIONARY OF DISTINGUISHED PEOPLE OF THE WORLD, EMBRACING THEIR NATIONALITY, VOCATION, GREAT ACHIEVEMENTS, AND DATES OF BIRTH AND DEATH; ALPHABETICALLY ARRANGED FOR READY REFERENCE..... 183

BOOK III.

EVERY DAY BUSINESS GUIDE

The Language We Speak

HISTORY OF OUR MOTHER TONGUE... 211
- Curious Changes of the Language.. 211
- How the Vocabulary has Grown.. 213
- How Foreign Words are Used.... 213
- The English Language for Ten Centuries 214

THE GRAMMAR OF THE ENGLISH LANGUAGE 215
- The Parts of Speech 215
- The Structure of a Sentence 217
- Mistakes in Grammar 217
- How to use Capital Letters........ 218
- The use of Punctuation Marks..... 219
- Helps in Spelling 221
- How to Write Clearly 222
- How to Write Forcibly 223
- The use of Figures of Speech 223

Rapid Business Writing

PRACTICAL LESSONS IN USING THE PEN 225
- What Materials to use 225
- Position of the Body and Movement 226
- How to Practice 227
- Plates I to X..................228-233
- Instructions on Plates 234
- Vertical Writing 235

Money and Business

- MONEY DEFINED 237
  - Gold and Silver Money 237
  - Paper Money 238
  - Money of the British Empire 238
  - Canadian Currency 238
  - Money in Foreign Lands.......... 239
- BANKS AND BANKING 239
  - How to Open an Account in Bank. 240
  - How to make a Deposit Slip...... 240
  - Checks 241
  - How to Draw and Endorse Checks. 241
  - Drafts and Bills of Exchange...... 244
  - Due Bills 246
  - Different Forms of Notes......... 246
  - Reckoning Interest 247
  - Discounting Note at Bank 247
  - Endorsements of Various Kinds.... 248
  - Proper Forms for Receipts........ 248
  - Bill of Sale 249
  - Business Correspondence 251
  - Model Letters 252-253
  - Points for Correspondents 254

The Science of Accounts

- METHODS OF BOOKKEEPING 255
  - The Object of Keeping Accounts... 255
- SINGLE ENTRY 256
  - Directions for use of Cash-Book.... 256
  - The Books used 256
  - Cash-Book 257
  - Trial List of Transactions 258
  - A Model Set of Accounts, Single Entry 258-265
  - Bill-Book 265
- DOUBLE ENTRY BOOKKEEPING, MODEL SET 266-276
  - Explanation 276
  - The Cash-Book 277
  - Journal 277
  - Ledger 277
  - Closing Books 278
  - Balancing Accounts 278
- VOCABULARY OF BUSINESS TERMS. .279-281

Rapid Calculations

- QUICKNESS IN FIGURES 282
  - In Addition 282
  - In Multiplication 283
  - The Use of Fractional Numbers... 283
  - Practice with Large Numbers..... 284
  - Lightning Table for Marking Goods 284
- CONVENIENT TABLES 285
  - Reckoning Board Bills by the Day or Week 285
  - For Reckoning Wages Under Weekly Contract 285
  - For Calculating Interest 285

BOOK IV.

EVERY DAY MECHANICS FOR MAN AND BOY

- HOW TO MAKE YOUR OWN REPAIRS... 289
  - How to Get Practical Knowledge.. 290
  - Why Carpentry is most Desirable.. 290
  - Bricklaying and Masonry 290
  - Kinds and Prices of Materials..... 291
  - Working Drawings 291
  - How to Judge Woods used in Carpentry 291-2
  - Strength and Breaking Strain of Materials 293
- TOOLS USED IN CARPENTRY 293
  - Striking Tools 294
  - Rasping Tools 294
  - Paring Tools 295
  - Other Tools 296
  - The Glue Pot 297
  - Recipe for Making Glue 297
  - Directions for Sharpening Tools ... 298
- DIVISIONS OF THE BUILDING TRADE... 298

Work in Metals 299
Decorative Work 299

Practical Points in Excavating... 300
Making Good Concrete 300
Bricklaying 301

Soldering and Brazing 302

Indoor and Outdoor Painting..... 303
The several Coats of Paint 303
Various Coloring Substances Used.. 304
Recipes for Making Varnishes 305
Practical Hints 306

Paper Hanging 306
Practical Directions 307-309

Electric Bells and Telephones 310
Making Connections 311
Alternating Currents 311
Directions for Wiring 312
Directions for Putting up Instruments 312
Operating a Telephone 313
Batteries 313

Facts and Figures for Every-Day Use

Wood Work 314

Stone and Brick Work 315

Iron Work 316

Workshop Recipes

Recipes for the Worker in Wood.317-18

Recipes for the Worker in Metal.317-18
Engines and Boilers 319-20

Tables of Measures and Weights

Linear, Square and Other Measures.. 321
Metric System and Tables 322
Miscellaneous Tables 323
Capacity and Volume 324

For Workers in Wood

Forests of the Earth 325
Forest Preservation 326
Useful Trees 327
Ornamental Woods 327
Useful Trees in the Philippine Islands 328
Lumbering Industry 329
Seasoning Timber 329
Many Uses of Wood 330
Annual Rings in Wood 330
The Manufacture of Wood Paper.. 330
Chemical Wood Pulp 330

Metals and Minerals

Science in the Use of Metal 331
Iron and Iron Ores 331
The Production of Iron 332
Coal Production 332
Bessemer Steel 332
Uses of Iron 333
The World's Gold and Silver Production 333
Gold and Silver Production of the United States 334
Iron and Gold Compared 334
Gold and Silver Production in the United States 334
Approximate Amount of Money in the World 335
Gold, Its Character and Sources.... 335
Placer Mining 336
Vein Mining 337
Silver Mining 337
Copper and Tin Production........ 338
Lead Production 338
Zinc 339
Nickel and Mercury 339
Aluminum 340
Other Metals 340

Petroleum or Rock Oil 341
Uses of Petroleum 341
Where Found 341

Natural Gas 342
Its Production and Its Value 342

Asphaltum 342

Clay and Stone ... 342
  How Clay is Utilized ... 342
  Manufacture of Porcelain ... 343

Mineral Productions ... 344

  Building Stones ... 343
  Value of Mineral Productions ... 344
  The Deepest Mines ... 344

Electricity and its Possibilities

The Nature of Electricity ... 345
  Electricity as a Force ... 345
  Magnetic Attraction ... 345
  Magnetic Repulsion ... 346
  Electro-Magnet ... 346
  Soft Iron Magnet ... 346

Art of Electrical Communication. 347
  History of the Telegraph ... 347
  Morse and His Invention ... 348
  Morse Alphabet ... 348
  Wheatstone Telegraph ... 349
  Ocean Cables ... 349
  The Great Eastern ... 350
  The Cable and Its Instrument ... 350
  Overhead and Underground Lines .. 351
  Duplex and Multiplex Telegraphy .. 351
  The Art of Electrical Communication 351
  Printing and Automatic Telegraphs. 352
  Wireless Telegraphy ... 352
  The Telephone ... 352
  Its History and Principle of Operation ... 353
  Telephone Receiver ... 353
  Telephone Statistics ... 354
  Long-Distance Telephone ... 354
  Electro-Metallurgy ... 355
  Phonograph ... 355

Other Uses of Electricity ... 356
  Electrotyping ... 356
  Medical Uses of Electricity ... 356
  Electricity in Agriculture ... 357
  Electric Light and Electric Motor .. 357
  Benefits of Electric Treatment ... 357
  The Dynamo ... 358
  Electric Motor ... 359
  The Arc Light ... 360
  Incandescent Light ... 361
  Storage Battery ... 362
  Electric Power and Its Transmission 362
  Chemical Action in the Storage Battery ... 363
  The Electric Railway ... 363
  Central Power House ... 364
  Feeders for Overhead Trolleys ... 364
  Progress of the Electric Railway ... 365
  Mileage of Electric Railways ... 365
  Elevated Electric Railway ... 365
  Electric Locomotives ... 365
  Electric Furnace ... 366
  Heating and Cooking by Electricity. 366
  Electric Blasting ... 367
  Electrocution ... 368

The Forces of Nature

Heat as a Motive Power ... 369
  The Steam Engine ... 370
  Low and High Pressure Engines .. 371

Other Motors ... 373
  Water Power ... 373
  Air Motors ... 374
  Compressed-Air Motors ... 375
  Hot-Air Engines ... 375
  Liquid Air ... 376
  Gas Engine ... 376
  Air Brake ... 376

Wind and Weather

The Causes of Winds ... 377
  Trade Winds ... 377
  Cyclones ... 378
  Origin and Path of Cyclones ... 379
  Tornadoes ... 380
  Temperature and Atmospheric Pressure ... 381
  The Use of Barometer ... 381

Weather Observations ... 382
  Weather Signals ... 383

BOOK V.

EVERY DAY ETIQUETTE AND LETTER WRITER

The Art of Conversation 387
  Practical Rules on Conversation . 388-390
  Principles of Politeness 391
  Flirtation 393
  Etiquette of Travel 395

Art of Dress 396
  A Well-Dressed Woman 396
  Suitability of Apparel 397
  Public Occasions 397
  A Well-Dressed Man 398
  The Shirt Waist 400

Introductions, Proper Forms 400
  The Introducer's Formula 401
  Calls, Formal and Informal 402

Visiting and Visitors 404
  Entertaining Guests 405
  Engraved and Printed Cards 406
  Rules for Leaving Cards 406

Balls and Evening Parties 407
  Subscription Dances 408
  The Question of Toilette 409
  In the Ball-Room 409
  Requests to Dance 410
  After the Ball 411

Breakfast, Luncheon and Tea 411
  Teas and Afternoon Receptions.... 412
  Theatre Parties 413
  Chaperons 414

Banquets and Dinners............ 414
  Choosing Guests 414
  Duties of Hostess 415
  Dress 416
  Dinner Courses 417
  General Hints 419

Courtship and Marriage........... 420
  Wedding Preliminaries 421
  Bridal Gifts 421
  Flowers 422
  The Bride 423
  House Wedding 424

Funeral Etiquette 425
  The Use of Flowers and Mourning. 426

Anniversary and Other Occasions. 427
  Etiquette of the Household 429
  Table Manners 429
  In the Electric Car 430
  Etiquette of Traveling 430
  Table Etiquette for Children 432

Forms of Invitation for Parties.... 433

Forms of Invitation for Dinners... 434

Forms of Invitation for Weddings. 435

Art of Letter Writing 437
  Forms and Styles for Correspondence 438-441
  Model Letters 442-447

Etiquette of Beauty

How to Grow Old Gracefully 448
Care of the Body 448
The Bath Room 449
The Complexion 450
Useful Recipes 451-458
Good Taste in Dressing 459
The Art of Appearing Always Young.. 460

BOOK VI.

EVERY DAY LAW AND LEGAL FORMS

Every Day Law

Form of Lease 462
Points of Criminal Law........... 463
  Embezzlement 463
  Grand Larceny 463
  Duties of Police Officer 463
  Murder 463

The Penalties for Violation of Criminal Law 464

BUSINESS LAW 464
- Laws Governing Negotiable Paper.. 464
- Laws Governing Bank Checks...... 464
- Outlawed Debts 464
- Liability of Endorser 464
- Law of Contracts 465

CONTRACTS AND AGREEMENTS 465
- Who Can Make Contracts? 465
- Things to be Avoided in Contracts.. 466

CO-PARTNERSHIPS 466
- Responsibilities of Members of Firms 466
- Special Partners 466
- Bankruptcy Law 466
- Interest Laws of Various States.... 466

AGENTS AND ATTORNEYS 467

LANDLORD AND TENANT 467

LAWS GOVERNING LIENS 468

COPYRIGHT LAWS 468

INTEREST TABLE 466

BOOK VII.

EVERY DAY COMPENDIUM OF REMARKABLE FACTS

The Seven Bibles of the World....... 471
The Nine Religions of the World.... 471
Distribution of the People of the Christian Religion 471
The Name of God in Forty-eight Languages 472
The Jewish Religion 472
Bramanism 473
Mohammedanism 473
Curiosities of the Bible 474
New Testament Chronology 474
Supposed Fate of the Apostles....... 475

ABOUT BOOKS AND WRITERS OF BOOKS. 476
- Assumed Names of Well-Known Writers 476-478
- Great Men's Readings 478
- Twelve Greatest Books of the Nineteenth Century 479

NEWSPAPERS OF THE UNITED STATES AND THE WORLD 479
- Statistics of Newspapers for 1900... 479

Lubbock's List of 100 Best Books 480
Ten Greatest Preachers 481
Ten Greatest Philosophers 481
Ten Greatest Reformers 481
Ten Greatest Historians 481
Ten Greatest Poets 481
Ten Greatest Painters 481
Ten Greatest Sculptors 481
The Largest Things in the World.... 481
The First Things 482
The Nineteenth Century in a Nut-Shell 483
Paris Exposition, 1900 483
Owners of Land in America 483
Principal Battles of the Civil War..... 483
Growth of the United States 484
How the Great Powers Have Changed. 484
Politics of the Presidents 485
Religion of the Presidents 485
Education of Presidents 485
Cabinet Facts of Interest 485
Salaries of United States Officers.... 486
Popular and Electoral Votes for Presidents 486
Eleven Great Wonders of America ... 487
Noted American Trees 487
Remarkable Plagues of Modern Times 487
Great Financial Panics 488
The Greatest Floods in History 488
The Greatest World's Fairs 489
Highest Buildings and Monuments.... 489
Famous Giants and Dwarfs 489
Remarkable Genius in Youth 490
Remarkable Memories 490

BOOK I.

EVERY-DAY REFERENCE DICTIONARY

ALPHABETICALLY ARRANGED, TELLING JUST THE THINGS ABOUT EVERY-DAY SUBJECTS IN SCIENCE, ART, MECHANICS AND ABOUT COMMON OBJECTS EVERYONE NEEDS TO KNOW, GIVING DERIVATIONS OF FOREIGN WORDS, ETC. AN INDISPENSABLE HELP FOR YOUNG AND OLD, AND ESPECIALLY FOR THE WRITER OF ESSAYS AND ARTICLES.

A READY REFERENCE ON A THOUSAND SUBJECTS

BY

CHARLES MORRIS, LL.D.,

Editor of Revised Edition of "Thomas' Biographical Dictionary," "Handy Dictionary of Biography"
and Author of Numerous Works of History, Biography and Science.

ENCYCLOPEDIC DICTIONARY

OF

COMMON THINGS

AND OTHER USEFUL INFORMATION

Abdo′men. [L. *abdomen.*] In the human body the trunk is divided by the diaphragm into two cavities—the upper being the thorax or chest, and the lower the abdomen or belly. The abdomen contains the stomach, liver, intestines, spleen, pancreas, kidneys, etc. It is lined by a serous membrane, which is folded over the organs, and allows them a certain freedom of movement, but keeps them in their proper relations to each other. (See *Bowels.*)

Aca′cia. A genus of plants of the Pulse family, including the catechu and gum-arabic trees. The species are numerous, are frequently thorny, and grow mostly in warm countries. Nearly 300 species are Australian or Polynesian and have vertically compressed leaf-stalks, instead of the bipinnate leaves of the much fewer species of Africa, etc. Very few are found in temperate climates, but many are cultivated in greenhouses for the sake of their flowers, which are of great beauty and often fragrant. The North American locust tree and other species of robinia are often called acacia in the United States and Europe, but wrongly.

Accord′ion. A small musical instrument, with keys and bellows, the tones of which are produced by the vibration of metallic springs, occasioned by a current of air rushing from the bellows through valves attached to the keys, and opened by the fingers of the player.

Ace′tic Acid. [L. *acetum*, vinegar; *acidus*, sour.] The most common of the vegetable acids, familiar to all as the sour principle in vinegar. It occurs in the juice of many plants, and in some animal secretions; but on the large scale it is prepared from damaged wines, by the fermentation of malt, or by the destructive distillation of wood. Pure acetic acid is prepared by the dry distillation of wood. The pure acid has a sour taste and a pungent smell, is poisonous, and burns the skin. In the arts it is used as a mordant in calico-printing, and in the preparation of certain varnishes. It is also used as a condiment and in medicine. The salts of acetic acid are called acetates, the most important of them being acetate or sugar of lead.

Acet′ylene. [L. *acetum*, vinegar.] A substance composed of carbon and hydrogen and of remarkable powers. It is not a new discovery but has only lately been produced in large quantities from carbide of calcium, a product of the electric furnace. When water is thrown on this substance it gives off acetylene gas. It was found about 1895, that this gas, when burned in a suitable burner, would give the brightest light of any known gas. When placed under strong pressure acetylene becomes a liquid, and the gas which arises from this is burned in suitable lamps, yielding a light twelve times as bright as that of ordinary coal gas. But this new light has not come into much use, for there is danger of explosion. Acetylene has other uses, for a great many chemical substances can be made from it, belonging to what are called the hydrocarbons.

Achromat′ic. [Gk. *achromatos*, colorless.] Free from color (applied to lenses, telescopes and microscopes); transmitting light without decomposing it into its primary colors.—*Achromatic lens*, a combination of two dissimilar substances, as crown and flint glass, so arranged that the chromatic aberration produced by the one is corrected by the other, and light passes undecomposed.

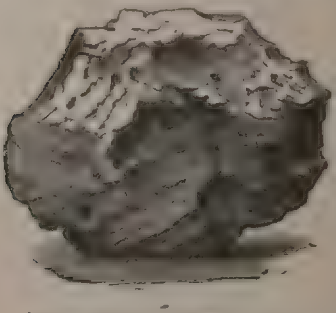
Ac′id. [L. *acidus*, sour.] A general term used in chemistry to designate a special group of substances, mostly, but not always, oxygen compounds. The chief distinguishing property of acids, and one which is common to all of them, is that of combining with bases to form salts. They are also distinguished by their *sour* or *acid* taste, and by the power of turning blue vegetable colors into red. These blue colors are litmus, syrup of violets or of radishes. When these blues have been changed into green by an alkali, their color is restored by an acid.

A′corn. [AS. *æcern*, from *æcer*, a field.] The seed or fruit of the oak, growing in a woody cup. Acorns contain starch and oil, and generally have a bitter taste. They are eaten freely by swine, while the fruit of some species are sweet and nutritious and are eaten by man. The oil has been used in cookery and for other purposes.

Ad′der. [AS.] A name often applied to the common viper, as well as to other kinds of venomous reptiles or serpents. In North America the term *adder* is commonly applied to several harmless snakes.

Adult′eration. [L. *adulteratio*, corruption.] The mixing of foreign substances with articles of food and drugs, of water with milk, etc., for the purpose of defrauding customers. This is a very common practice, and often renders drugs useless and food injurious, if not poisonous. Many laws have been passed to check it, but not with full effect.

Aeo′lian Harp. [L. *Æolus*, the god of the wind.] A box of very thin wood, with strings of catgut or other vibratory material stretched across it, and sounding holes cut in the top. When placed in a current of air, as in a window between the raised sash and the sill, it yields a music sweet in tone, but usually sad in character.



A′erolite. [Gk. *aer*, air, and *lithos*, a stone.] A meteoric stone that comes into the atmosphere from space and falls to the earth. It is of the same nature as the shooting stars, small particles, which become so hot from friction with the atmosphere that they are burned up. Aerolites are very hot when they first fall. They are largely made up of pure iron, but contain also nickel, silicon, and other elements. Some very large ones have been found weighing many hundreds of pounds.

Af′terglow. The brilliant twilight colors often seen after sunset. These are of red and yellow tints and sometimes are very lasting. If seen before sunset they are called **foreglows.**

Ag′ate. [L. *achates*; so called from the name of the river Achates in Sicily, where it was first found.] A variety of quartz, found in loose rounded pieces in rocks, or as loose pebbles in beds of rivers or gravel. Wood may be converted into agate by infiltration with waters carrying silica in solution, as in the celebrated petrified forest of Arizona. Agates show various tints in the same specimen, and the colors are delicately arranged in stripes or bands, or blended in clouds. They take a fine polish, and are much used in the manufacture of rings, seals, beads, handles of knives and forks, cups, smelling bottles, and many other ornamental articles. Burnishers for polishing, used by bookbinders, are made of agate.

Aga′ve. The name of a genus of plants growing in tropical America. The principal species is known as the American Aloe, or century plant, under the idea that it blooms but once in a hundred years. This is a mistake, its period of blooming being about ten years. It is called *maguey* by the Mexicans, who distil from its sap an intoxicating drink. The coarse thread called sisal hemp is made from the fibres of its leaves.

A′gue. [L. *acutus*, sharp.] An intermittent fever, consisting of hot and cold stages in succession, with an intermediate period. It comes on at fixed periods, one, two, three, or more days apart. It is now generally known as malarial fever. Long supposed to be due to marsh miasma, it is now traced to a bacterial germ, and there is much reason to believe that the mosquito is the carrier of this germ, which it injects into man with its bite.

Air. [Fr., from Gk. *aer*, air; *aein*, to blow.] The gaseous fluid which we breathe and which surrounds the earth. It is a mixture of oxygen and nitrogen, with a small amount of carbon dioxide, the average proportions being, by volume: oxygen, 20.96 per cent.; nitrogen, 79.00 per cent.; carbon dioxide, 0.04 per cent. (See *Atmosphere; Compressed Air; Liquid Air.*)

Air Bladder or Swim Bladder. A membranous sac found in most fish, which contains a quantity of gas, and is thought to help the fish to rise and sink in the water. It is very small in some fish, quite large in others, and wanting in sharks and some other fish. In some cases it is converted into a sort of lung and is used as a breathing organ.

Air-brake. A brake now used on railroad cars and engines, invented in 1869, by George Westinghouse, of Pittsburg. Air is compressed by the steam of the engine boiler, and carried in tubes to the car wheels, where it exerts its pressure on the brakes when it is desired to stop the train. (See *Brake.*)

Air-gun. A gun which uses compressed air instead of gunpowder to drive out the bullet. There is a piston to force the air into a cavity, and a valve opened by the trigger, which lets the air out against the bullet. This is driven out with some force. Air guns are of little use.

Air-pump. An instrument for the withdrawal of air from a closed vessel, producing an empty space or vacuum; in ordinary air-pumps the vacuum is very far from complete, and in the most perfect of them some air remains. Many interesting experiments may be performed in the exhausted receiver of an air-pump, such as the boiling of water at a much lower than the usual temperature, and the extinguishing of a candle, a proof that air is necessary to combustion.

Al′abaster. [Gk. *alabastros.*] A fine-grained whitish limestone or marble. It is of two kinds, one of which is a carbonate of lime, the other a sulphate of lime or gypsum, and to the latter the term is now generally applied. It is carved into vases, mantel ornaments, statuettes, etc.

Al′batross. [Span.] A genus of large, web-footed, aquatic birds, allied to the gulls. They are the largest of sea-birds, capable of long-continued flight, and are often seen hundreds of miles from land. They are found chiefly in the southern hemisphere.

Albu′men or **Albu′min.** [L. *albus*, white.] A nutritive substance found in animals; also a supply of nourishing matter within the integuments of the seed in many plants, external to the embryo or germ in some, and within it in others. It is the floury part in wheat and other grains, and is a very important part of food. Albumen exists in many of the solids and fluids of the animal body, also in many plants. It occurs in its purest form in the white of an egg, and in the serous or liquid portion of the blood. It is a yellowish, transparent, gum-like substance, soluble in cold water. One of the most characteristic properties of a solution of albumen is its power of coagulation. If a solution be heated to about 70°, it becomes solid and opaque, and in this state it is insoluble in water, but dissolves in dilute alkalies.

Al′chemy. [Ar. *Alkimia.*] A pretended art arising from chemistry, by which it is sought to make gold or silver out of baser materials, or to produce a universal medicine. The conversion into gold was to be effected by what was called the *philosophers' stone.* Alchemy was practiced for many centuries, but its only important result was the discovery of various chemical elements, such as sulphuric, nitric and muriatic acids.

Al′cohol. [Fr., from Arab.] A volatile organic substance produced during the fermentation of vegetable juices which contain sugar. It is a colorless, limpid liquid, possessing an agreeable smell and burning taste; is very inflammable, and burns with a bluish flame. It is used for thermometers in measuring low temperatures, and can be employed down to –39 F. It is prepared from spirituous liquors by successive distillations. The alcohol being more volatile than water, comes off first; but it cannot be entirely separated from water by this process, since the strongest spirit so obtained contains 10 per cent. of water. To obtain pure alcohol, this water has to be removed by distilling the spirit with some substance capable of combining with water, such as quicklime or potassium carbonate. To the chemist alcohol is very useful as a solvent, and in medicine as a solvent and antiseptic agent. It is the alcohol in spirits, wines, and malt liquors to which the intoxicating effects of these beverages are due. In chemistry the term alcohols is applied to a considerable number of liquids which resemble ordinary alcohol in certain chemical reactions, and include methyl, propyl, and various other compounds.

Al′der. [AS. *alr* or *aler*, L. *alnus.*] A genus of plants, consisting of trees and shrubs, growing chiefly in moist soils. The wood is used by turners, and is very valuable for mill-wheels and other wood-work under water. It affords the best kinds of charcoal for making gunpowder, and its bark is used by dyers and tanners.

Ale. [AS.] A liquor made from an infusion of pale malted barley by fermentation with a bitter, usually hops. (See *Beer.*)

Al′gebra. [Arab. *al-jebr*, reduction of parts to a whole.] A sort of universal arithmetic, in which the unknown terms are expressed by letters of the alphabet, and dealt with as if known. By this means very intricate problems can be solved, which would be impossible with ordinary figures. In the higher mathematics algebra is of extreme importance.

Aliz′arine. [Fr. *alizarine.*] A peculiar coloring principle obtained from madder, and now produced artificially from the coal-tar product anthracene. It is the coloring matter used in the dyeing of Turkey red.

Al′kali. [Arab.] The name applied in chemistry to a class of bodies possessing the following common properties:—(1) They have the power of turning vegetable blue colors green, and vegetable yellows brown; (2) they restore the color to a blue solution which has been reddened by an acid; (3) they have a strong affinity for acids, combining with them to form salts which possess neither acid nor alkaline properties—hence an acid and an alkali are said to neutralize one another; (4) they are all soluble in water. The alkalies proper are four in number—potash, soda, lithia and ammonia. They exert a powerfully corrosive action on animal and vegetable substances. As bicarbonates they are often used along with carbonic acid to correct acidity of the stomach.

Al′ligator. [Span. *el legarto*, the lizard.] A large American reptile of the Crocodile family. It has a shorter and broader snout than the crocodile, and the large teeth of the lower jaw fit into pits in the edge of the upper jaw, which has no notches. Alligators vary in length from 2 to 20 feet, the head being about one-seventh of the entire length. They embrace three genera, the alligator, abundant in Florida, and the caiman and jacare, found in tropical South America. The caiman is also found in Mexico. Their principal food is fish, but they catch and devour land animals, as the sheep and pig, and sometimes even men. An alligator lays from 50 to 60 large eggs in a hollow in the mud, covered over with grass and reeds, and leaves them to be hatched by the sun. The young take to the water as soon as hatched, being carefully tended by the mother alligator. The skin when tanned makes good leather for boots and shoes.

Alloys′. [Fr. *a loi*, from L. *ad legem*, according to rule.] The name given to the mixtures which result from fusing different metals with each other. Both gold and silver when pure are too soft for the manufacture of plate, coin, or jewelry; but when mixed with a small percentage of copper, they are rendered harder and more durable, without suffering any loss in color. One of the most useful alloys in the arts is brass. It consists of zinc and copper, and the proportion of each metal in the compound is regulated to suit the quality of the brass required. Among the important alloys of copper and tin are (1) bronze, containing 90 parts of copper and 10 of tin; (2) bell-metal, containing 80 parts of copper and 20 of tin; (3) speculum-metal, containing 67 parts of copper and 33 of tin. Type-metal varies somewhat in its composition; one variety consists of 80 parts of lead and 20 of antimony. Aluminium-bronze and nickel-steel are important recent alloys. The alloys of other metals with mercury are termed *amalgams*, and the process of amalgamation has long been employed in separating fine gold from other materials.

All′spice. From a tree of the Myrtle tribe, a native of the West Indies, allspice, or Jamaica pepper, is obtained. Allspice is the dried berry; it is so called because it is considered to have the flavor of cloves, cinnamon, and nutmeg combined. It is mildly pungent and agreeably aromatic.

Al′manac. A book or pamphlet telling the divisions of the year into months, weeks, and days, the times of rising and setting of the sun and moon, movements of the tides, eclipses, and other information about the earth and the stars. Almanacs formerly pretended to foretell the weather, but only ignorant persons beleived this. Almanacs are now published giving many facts of official and other kinds. "Poor Richard's Almanack," published by Benjamin Franklin in 1732, is a well-known and interesting almanac. It was published for 25 years and was filled with wise and pithy sayings, inculcating industry and frugality as helps to virtue.

Al′mond. [Fr., from Gk. *amygdalon*.] The fruit of the almond tree, a native of the East and of Africa, grown in the countries around the Mediterranean, and of late years produced in large quantities in California. The fruit or nut is covered with a hard green shell, which dries as it ripens, and finally bursts open and lets the almond drop out. The principal varieties in cultivation are the sweet, bitter, thin-shelled, thick-shelled, and Jordan almonds. Sweet almonds are used in confectionery and for dessert. They contain a large quantity of a bland fixed oil, are of a very agreeable taste, and very nutritious. Bitter almonds contain a substance called amygdalin, from which a peculiar volatile oil is obtained. The Jordan almonds, brought from Malaga, are the finest. Almond wood is a very hard, dense wood, something like lignum vitæ. It is used for the teeth and bearings of wooden cog-wheels.

Al′oe. [L. *aloe*.] A genus of succulent trees and shrubs of many species, but the greater number having the habit and appearance of evergreen herbaceous plants. They are natives of warm climates, and flower only once, after a growth of from fifty to one hundred years. The fibres of the leaves are manufactured into thread, cords, and nets, and stockings are woven from the fibres of a species found in Jamaica. But aloes are chiefly valuable for their medicinal properties, the drug called aloes being obtained from the juice of several species.

Alpac′a. An animal of Peru, having long, fine, woolly hair; a species of llama (*q. v.*). The thin cloth called alpaca is woven out of alpaca wool, mixed with silk or cotton.

Al′phabet. [Gk. *Alpha* and *Beta*, the first two letters of the Greek alphabet.] The name given to the series of letters of which the words of any language are made up. Alphabets are very ancient, and every civilized nation has one of its own. In the Hebrew there are letters for the consonants only. Some alphabets have a letter for each syllable, and the Chinese have a character for every word. The English alphabet has twenty-six letters. Some have fewer and some more, the Russian having thirty-six.

Al′um. [L. *alumen*.] A white saline compound used in dyeing and many other industrial processes. Chemically it is known as a double sulphate of potassium and aluminium. It has an astringent and sweetish taste, turns vegetable blue colors red, dissolves in water and melts when heated. When more strongly heated it loses its water of crystallization, leaving the white substance known as burnt alum, which is used as a caustic. It has many highly important uses in the arts, as a mordant in dyeing, etc., and in medicine it is of great use as an astringent in stopping bleeding. Wood and paper which have been dipped in a solution of alum are less liable to catch fire.

Alumin′ium. [L. *alumen*.] A white metal, somewhat like silver in appearance. It occurs chemically combined in all the older rocks and in clay. It is very malleable, and therefore capable of being hammered into thin sheets or drawn into fine wire. Being highly sonorous, it is a suitable substance for bells. It is very light, being only 2½ times heavier than water, and therefore 4 times lighter than silver. It melts when heated to redness, and has no action on water at ordinary temperatures. On account of its bright lustre, hardness, and malleability, it is largely used for jewelry, for balance beams, and in making sextants and other astronomical instruments, and on account of its lightness for many other purposes. It forms alloys with most of the metals. It was first discovered in 1828, and was not produced in commercial quantities until 1855. It is now cheaply produced by electricity.

Amal′gam. [Fr., from Gk. *malagma*, a plaster.] An alloy of mercury with another metal or metals. Amalgams are largely made use of in the arts. Metals are sometimes gilded by washing them with an amalgam of gold and mercury; the mercury is then driven off by heat, leaving the gold on the metal.

Am′ber. [Arab]. A hard, yellow, translucent resin, found as a fossil in beds of lignite, in alluvial soils, and on sea-coasts, especially the Prussian coast of the Baltic. It takes a fine polish, and is much used for making ornaments, such as necklaces, earrings, pendants, and beads; for the mouth-pieces of pipes and cigar-holders, and for burning for perfume. It is also used as a basis for a fine varnish. By friction it becomes strongly electric.

Am′bergris. [Fr. *ambre gris*, gray amber.] A substance found floating in the sea or thrown upon the coasts in warm climates, and also in the intestines of the sperm whale, which is believed to be in all cases its true origin. The floating masses are sometimes from 60 to 250 lbs. in weight. In color it is gray, yellow, white, or black, and often variegated like marble. It is much used in perfumery, and to improve the flavor of wines and cordials. In Asia and Africa it is used as a medicine, also as a condiment in cooking.

Am′ethyst. [L. *amethystus*, from Gk. *amethystos*, without drunkenness, because the ancients believed that liquor drunk out of cups made of amethyst would not intoxicate.] A variety of rock-crystal or quartz, of a purple or bluish-violet color, much used as a precious stone for rings, seals and other ornaments.

Ammo′nia. [Gk. *Ammon*, a name of Jupiter.] A chemical compound of hydrogen and nitrogen, containing three atoms of the former to one of the latter. It is an alkaline substance; but as it differs from the other alkalies (see *Alkali*) in being gaseous, it is often called the *volatile alkali*. The gas is colorless, and has a very strong and pungent smell, by which it is easily recognized. It is found in minute quantities in the air, being evolved during the putrefaction of animal and vegetable substances. Traces of it are also found in rain-water and in the breath. Water absorbs it readily, hence ammonia is said to be very soluble in water. The solution is known to chemists as *liquor ammoniæ*, and in shops it is sometimes sold under the name of *hartshorn*. Liquor ammoniæ is sometimes used in medicine; it has a stimulating action on the breathing, and is useful in alleviating spasms, and to some extent in counteracting the effects arising from the bites of snakes and poisonous insects. By the evaporation of liquid ammonia great cold is produced, and this fact is utilized in the manufacture of ice in ice-machines.

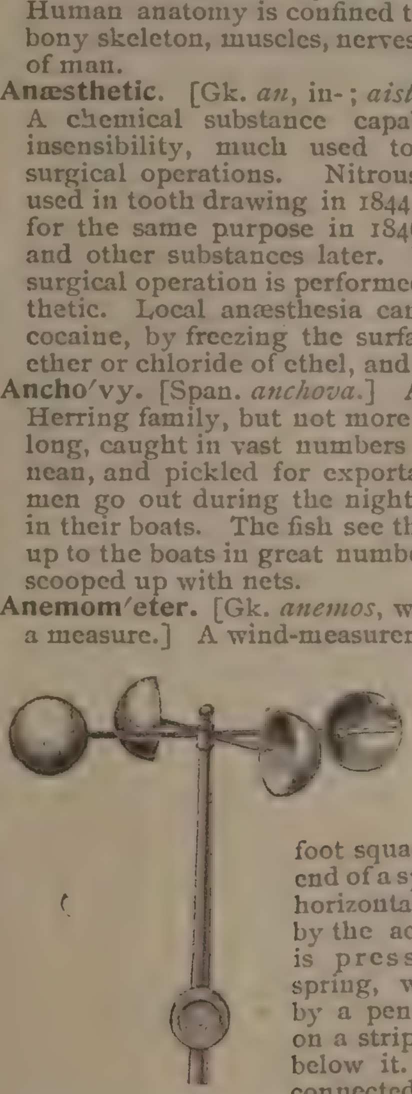
Am′ulet. [L. *amuletum*.] An ornament or any object which is worn as a safeguard against enchantment, disease, or ill fortune. It is generally inscribed with mystical characters. Amulets were greatly used in the past, and are still in use among undeveloped peoples.

Anat′omy, Comparative. [Gk. *anatome*, dissection.] The study of the structure of animals, and comparison of their various organs with one another and with those of man. It is by this study that animals are separated into families, genera, species, and other divisions. Human anatomy is confined to the study of the bony skeleton, muscles, nerves, and other organs of man.

Anæsthetic. [Gk. *an*, in-; *aisthesis*, sensibility.] A chemical substance capable of producing insensibility, much used to prevent pain in surgical operations. Nitrous oxide was first used in tooth drawing in 1844. Ether was used for the same purpose in 1846, and chloroform and other substances later. Now no important surgical operation is performed without an anæsthetic. Local anæsthesia can be produced by cocaine, by freezing the surface with a spray of ether or chloride of ethel, and in other ways.

Ancho′vy. [Span. *anchova*.] A small fish of the Herring family, but not more than three inches long, caught in vast numbers in the Mediterranean, and pickled for exportation. The fishermen go out during the night, carrying torches in their boats. The fish see the light, and swim up to the boats in great numbers, when they are scooped up with nets.

Anemom′eter. [Gk. *anemos*, wind; and *metron*, a measure.] A wind-measurer, to show both the *pressure* and the *velocity* of the wind. A pressure anemometer measures the force of the wind on a plate one foot square attached to one end of a spiral spring placed horizontally. The plate, by the action of the wind, is pressed against the spring, which yields, and by a pencil traces a curve on a strip of paper placed below it. Another pencil connected with the vane records the changes in the direction of the wind. Thervelocity of the wind is indicated by the revolution of wheels, the number of whose turns is recorded automatically.



Anem′one. [Gk. *anemos*, the wind.] So named because the flower was thought to open only when the wind blows. A genus of plants belonging to the Buttercup family. There are several species, one of which has a flower, white internally, more or less purple externally. Sea Anemone is the name given to certain ocean animals, of the Polyp family, which bear some resemblance to flowers.

An′eroid. (See *Barometer.*) [Gk. *a*, not; *neros*, wet; and *eidos*, form.] A barometer whose action depends on the varying pressure of the atmosphere upon the elastic top of a metallic box from which the air has been exhausted. By a system of levers connected with the box, and an internal spring, motion is given to an index, which registers the variation of atmospheric pressure.

An′iline. [Ar. *annil*, for *alnil*, the indigo plant.] Aniline was first prepared from indigo in 1826, and takes its name from *anil*, the Portuguese word for indigo. It is now derived from the distillation of coal-tar. It is a colorless liquid, possessing a peculiar smell, and slightly heavier than water, and boils at a temperature of 360°F. The aniline of commerce was first obtained in 1858 by a Mr. Perkin, in the preparation of a dye-stuff derived from aniline. This was known as mauve or Perkin's blue. Every shade and tint of color are produced by the aniline dyes, which are used not only in dyeing, but in preparing colored inks, in manufacturing colored papers, in printing wall-paper, and in coloring soaps, perfumes and cosmetics.

An′imal. [L. *animal*, a living being; *anima*, breath.] A living being with an organized material body, and endowed with the powers of sensation and voluntary motion. All animals are classed together in one great body called the Animal Kingdom, which is separated into a number of sub-kingdoms or grand divisions, of which the highest is the vertebrata, or animals with an internal skeleton.

Ant. [Contracted from the Saxon word *emmet.*] An insect of the family *Formicidæ*, which embraces between two and three thousand different forms, widely distributed in temperate and tropical countries. Ants usually live together in swarms, sometimes many thousands in number, and are distinguished from insects generally by their extraordinary intelligence. Among them, as among bees, there are workers, besides the males and females. The females are the largest, the males next in size, and the workers the smallest and without wings. Ants are very active and strong for their size, and among the most industrious of all animals. Their dwellings usually consist of hillocks of earth, most wonderfully constructed, and containing many little rooms, in which they store their provisions, and nurture their young. The food of ants consists chiefly either of animal matter, or of sweet vegetable substances, such as honey, sugar, and fruit. There are many species of ants, differing considerably in their habits—as the agricultural, carpenter, foraging, honey, amazon, etc. They have many remarkable habits, fighting battles in which large armies take part, keeping and milking the aphis, or ant-cow, cultivating certain grasses with palatable seeds by the destruction of other species, and displaying other evidences of high intelligence. The insects known as termites, or white ants, are not properly ants, but belong to a different class of insects, yet resemble the ants in intelligence. They live in hot countries, and sometimes gnaw out all the inside of the beams of houses, leaving only a thin casing. In Africa white ants live together in vast colonies, some living in houses which they dig underground, some burrowing in wood, while others build up large mounds, ten or twelve feet high, with smaller mounds around them.

An′telope. [Gk. *anthein*, to flower or shine; and *ops*, the eye.] A genus of ruminating animals, intermediate between the deer and the goat. Their horns are hollow and permanent, not annually renewed; those of the deer are solid, and shed every year. Their horns are also round and curved, with rings running round them, and are always black. There are many species in Africa, about fifteen in Asia, two, the chamois and the saiga, in Europe, and two, the pronghorn and the Rocky Mountain goat, in North America. In Africa, particularly in South Africa, antelopes are very abundant, some of the species congregating in immense herds. Their sizes vary from the Guavy, or Pigmy Antelope of Africa, only eight or nine inches high, to forms which are five or six feet high. Most of them yield palatable food, and they are much hunted.

Anten′næ. [L. *antenna*, sail-yard.] Slender articulated organs on the head of insects and crustacea. There are two in the former, and usually four in the latter. They are used as organs of touch, and in insects are called *horns* or *feelers*.

An′thrax. [Gk. coal.] This was the name formerly given to the painful swelling or eruption now called carbuncle. It is now used for a disease often fatal to sheep and cattle, and occasionally attacking man. It is also destructive to horses and camels and many of the smaller animals. When acute, the animal falls and goes into convulsions, and soon dies. The disease has been known by many names. In man it is called Malignant Pustule, Wool-sorters' Disease, etc. It is believed to be due to a minute germ, named *bacillus anthracis*, which enters the system and multiplies in the blood with great rapidity.

An′thracite. [Gk. *anthrax*, coal.] A species of hard mineral coal or carbon, of a metallic lustre, containing little or no bitumen. It is difficult to ignite, but burns with intense heat and nearly without smell, smoke, or flame. It is principally found in Eastern Pennsylvania and is said also to be abundant in China.

Anthropol′ogy. [Gk. *anthropos*, man; *logos*, a discourse.] The science of man. It includes the study of man as an animal and as a thinking being, and ethnology, or the study of race divisions. It includes, in short, all that can be learned about man in any direction.

An′timony. [L. *antimonium*.] A metal of a bright bluish-white color and crystalline structure. When strongly heated it burns with a white flame, giving off the fumes of "flowers of antimony," a compound with oxygen. It is a bad conductor of heat and electricity. It does not rust or tarnish when exposed to the air at ordinary temperatures. This property, combined with its hardness, renders it of great service in the arts in the formation of alloys. Pewter, type metal, Britannia metal, are all alloys of antimony. The metal is generally prepared from the mineral stibnite, a compound of antimony and sulphur. This ore is found in France, Spain, Italy, Canada, Borneo, and Australia. It has been long used in Eastern countries for darkening the eyebrows. *Tartar-emetic* contains antimony, tartaric acid and potash.

Antisep′tics. [Gk. *anti*, against, *septikos*, putrefying.] Substances which act to prevent decay or putrefaction of organic materials. Among the many antiseptics may be named sugar, alcohol, carbolic acid, charcoal, nitre, alum, and chloride of zinc. They are used for the preservation of food substances. Cold has a powerful antiseptic action, and cold storage is one of the best and cheapest of food preservers. Antiseptic surgery or Listerism is a mode of treating surgical wounds, introduced by Sir Joseph Lister. In this the wound and the instruments are treated with carbolic acid or other antiseptics to prevent dangerous germs from entering. This has proved wonderfully successful, and has enabled surgeons to perform operations successfully which would have led to certain death under the old system of treatment.

ANVIL AND HAMMER

Anvil. [AS. *on*; and *fyllan*, to strike.] An iron block, usually with a steel face and a pointed end, upon which metals are hammered and shaped. Anvils are of various sizes, from the small steel ones used by goldsmiths to the immense cast-iron ones used under steam-hammers.

Ape. [AS. *apa*.] A term generally applied to the monkeys, though by some the Anthropoids, or highest forms, are not included in the apes. Others consider these the only apes. They usually dwell in trees, where their power of grasping with both hands and hand-like feet enables them to grasp the limbs with great ease, and to jump from branch to branch without danger of falling. They closely approach the human species in anatomical structure, and the higher forms, the gorilla, chimpanzee, and orang-outang, are often called anthropoids, or man-like apes.

A′phis. The plant louse; a kind of insect which is parasitic upon plants, injuring them by sucking their juices. They are extremely prolific and very injurious. They exude a sweet, viscid fluid known as honeydew of which ants and bees are very fond, and ants often take care of and seem to milk the aphides. These are therefore known as ant cows.

Appendici′tis. [L. *appendix*.] This is a name given of late years to inflammation of the vermiform appendix, a small, finger-shaped tube, depending from the large intestine. Many deaths in the past whose cause was unknown, may have been due to it. If severe, it is now often healed surgically, the abdomen being opened and the inflamed appendix removed, or otherwise treated.

Ap′ple, [AS.] One of the most widely diffused of fruit-trees, growing best in the colder parts of the temperate zone; also its fruit. The tree attains a moderate height, with spreading branches bearing beautiful flowers that have a delicate fragrance. The fruit is roundish in shape, with a depression at each end. The original of the cultivated apple is the wild apple or crab-tree, found in most of the countries of Europe. Though there were no apples in America when it was first settled, trees were introduced, and some of the finest apples, such as greenings, baldwins, Newtown pippins, etc., are now grown, and sent in large quantities to Europe, China and India. The number of varieties of the apple produced by cultivation is very large, and it is perhaps the most useful to man of all the fruits. The wood of the apple-tree is hard, close-grained, and often richly colored, and is used by turners and cabinet-makers.

A′pricot. [Fr. *abricot*, from L. *præcox*, early ripe.] A stone fruit, belonging to the same genus as the plum, but resembling a peach, being of an orange color, oval shape and delicious taste. The tree grows wild in Armenia and the countries eastward to China and Japan, and by cultivation it has been introduced throughout the temperate zone. It was brought into Europe in the time of Alexander the Great, and into England about the middle of the 16th century. The dried apricots of Italy are sent to foreign countries, those of Bokhara and other parts of the East to Russia, while the preserved apricots of Damascus are famous. Many apricots are now raised in California.

Aqua′rium. [L. *aqua*, water.] An artificial pond, or a globe or tank (usually with glass sides), for containing and showing aquatic animals and plants and their modes of living. Small aquariums are now often kept in houses for study and amusement.

A′queduct. [L. *aqua*, water, and *ductus*, passage.] An artificial channel to convey water for city supply and other purposes. The Romans had great stone aqueducts, in some places raised on high arches, in others cut through the hills. Some of these are still in use. Some of the largest of modern aqueducts are the Croton Aqueduct, which conveys water to New York City, and the Cochituate Aqueduct, of Boston, which is fifteen miles long.

Arch. [L. *arcus*. Fr. *arche*.] A self-sustaining structure, usually of a curved form, made up of separate wedge-shaped solids, with the joints between them disposed in the direction of the radii of the curve, used to support the wall or other weight above an opening. The beginning of the arch is called the spring, the two bottom stones being the springers, the middle the crown or keystone, and the parts between the crown and the spring the haunches. A flat arch is constructed of stones cut into wedges or other shapes, so as to support each other without rising into a curve.

Archæol′ogy. [Gk. *archaios*, ancient.] The study of the ancient relics of human art. These are very numerous, and are found in all parts of the earth, advancing from the rough tools and weapons of the stone-age to the splendid examples of the five arts found in the mines of ancient Greece.

Ar′chery. [L. *arcus*, bow.] The art of shooting with a bow and arrow. This was in very common use before the invention of firearms, and archery is still practiced as an amusement. The bow is usually made of yew or ash, and the arrows of ash. A good archer can send an arrow from 200 to 250 yards. In the Middle Ages the fate of battles was often decided by the skill of the archers.

Ar′gon. A gas existing in the atmosphere, first discovered in 1895 by Lord Ragleigh and William Ramsay. It is heavier than nitrogen and occurs in a very minute quantity. The discoverers were rewarded by the Smithsonian Institution with a prize of $10,000, offered for the most important new fact concerning the atmosphere.

Armor. A protection worn in ancient time consisting of helmet, body armor, and limb armor, though varying at different periods in the amount of the body covered. The shield served as a moveable piece of armor. Since the invention of gunpowder armor has been of little use and hence has been discarded.

Armor-plate. The larger and more powerful warships are in these times covered with a strong armor made of thick plates of steel, in some cases from 16 to more than 20 inches thick. The steel is often alloyed with nickel to make it harder, and its surface is specially hardened, so as to enable it to resist the blows of the great shot from modern rifled cannon. The armor-plate is carried below the water-line, and covers the gun turrets, while thinner plate is laid on the decks. Not only battle-ships, but forts, are now made strong by armor-plate, which shields the men, and behind which the guns are drawn down after firing.

Ar′rowroot. A kind of starch used as food, obtained principally from the root of a West India plant now cultivated in many warm countries, and from some other plants. It is said that the Indians used the root to cure the wounds made by poisoned arrows, hence the name.

Ar′senic. [Gk. *arsen*, a male (on account of its strength).] A metallic element, seldom found free in nature, but frequently found in combination with other elements, such as sulphur, iron, cobalt, and nickel. The metal is generally prepared from arsenious oxide, or *white arsenic*, one of its compounds with oxygen. It has a bright-gray lustre; it tarnishes in the air by oxidation; its weight is about five and a half times greater than water; when heated to dull redness it rises into vapor without first fusing, and its vapor emits a strong odor of garlic. Metallic arsenic is not of great importance in the arts. An alloy of copper and arsenic produces a brilliant gray metal used in the manufacture of buttons. A compound of arsenic and copper forms a bright substance largely used as a pigment under the name of *Scheele's green*. It was formerly much employed by paper-stainers in the manufacture of wall paper. Sheep-dipping mixtures consist of a compound of arsenic and soda dissolved in a large quantity of water, together with soap and sulphur. Arsenic has long been used as a medicine, and is used in some countries with the belief that it improves the complexion, but it is a dangerous poison, being fatal to adults in doses of from 2 to 3 grains. No effective antidote to it is known.

Art. An art is something performed by man through the instigation of the mind. In use the word is divided into the Common and the Fine Arts. A common art is something done for the benefit of man, such as the arts of manufacture. A fine art is something done for the enjoyment of man, as the art of painting.

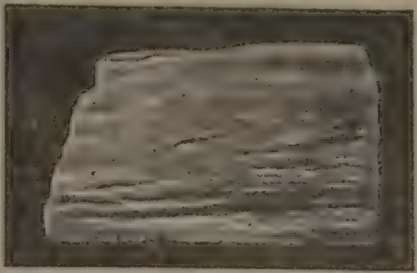
Ar′tery. [Gk. *arteria*, the windpipe; a blood-vessel.] One of the vessels or tubes which carry arterial blood from the heart throughout the body, and venous blood from the heart to the lungs. They have thicker and more muscular walls than veins, and are connected with them by capillaries. In man and other mammals the arteries which contain arterialized blood receive it from the left ventricle of the heart through the aorta. The pulmonary artery conveys the venous blood from the right ventricle to the lungs, whence the arterialized blood is returned through the pulmonary veins.

Ar′tesian Wells. In nature it often happens that a layer of water collects between two strata, such as clay, through which water cannot penetrate. If the ground from which the water has been gathered is high, the pressure at the bottom of the layer will sometimes be very great; and on boring through the retaining bed, the pressure of the water will be sufficient to force it up the shaft to the surface of the ground, and in some cases to cause it to spring into the air from the mouth of the well. This is in accordance with the hydrostatic law that water rises to its own level. In Europe, this method of boring was first practiced in the ancient French province of Artois (hence the name Artesian); but it is now extensively applied in all parts of Europe, in America, and in other parts of the world. The artesian well at Greuelle, near Paris, is 1,798 feet deep; another at Passy, near Paris, is 1,923 feet deep. In America the borings reach a depth of from 2,000 to 3,000 feet. The water from these deep wells being always warmer than surface water, maintains a constant temperature in hospitals and manufactories, warms greenhouses, and reduces variations of cold in fish-ponds.

Ar′tichoke. [Ital.] A plant like the thistle, but having large, scaly heads like the cone of the pine tree. It is cultivated in the south of Europe, and is much esteemed as an article of food. The unripe flower-heads are boiled, and the fleshy lower part of the scales or leaves eaten, dipped in olive oil or butter, with a little salt and pepper.

Artil′lery. [Fr., from Low L., *artillare*, to make machines.] Weapons of war; large ordnance, including guns, howitzers, mortars, rockets, and engines of war of all kinds, with their carriages, ammunition, and apparatus. Also the men and officers of that branch of the army to which the care and management of artillery are confided.

Asbes′tos. [Gk. *asbestos*, that cannot be quenched.] A mineral substance, unaffected by fire, occurring in long and delicate fibres, or in fibrous masses or seams, usually of a white, gray, or green-gray color. The finer varieties have been wrought into gloves and cloth which are incombustible. The cloth has been recommended for firemen's clothes. Asbestos is also employed in the manufacture of iron safes, fireproof roofing, and lamp-wicks, and is used, as a poor conductor of heat, for packing around steam pipes, valves, etc. The largest mines are in the province of Quebec, Canada.



Ash. [AS.] A genus of trees of the Olive family, mostly natives of Europe and of North America. There are about fifty species. The common ash is a beautiful and umbrageous tree, highly ornamental in parks, growing generally with a smooth stem to a height of from 100 to 150 feet, its wood being white, tough, and hard, in value next to that of the oak, and much used by wheelwrights, coachmakers, joiners, and turners. Among other varieties, the weeping ash, the curl-leaved ash, and the entire-leaved ash may be mentioned. The most important ones in the United States are the white ash, the black ash, the red ash, the blue ash, and the swamp ash. The white ash has the best wood, and is used for the same purposes as that of the common ash. The manna of commerce is a sugar from the sap of the manna ash, a kind of ash tree growing in Southern Europe, especially in Sicily, whence the finest manna is obtained.

Asp. [Fr., from Gk. *aspis*, an asp.] A small, hooded, poisonous serpent of Egypt and Libya, whose bite is often fatal.

Aspar′agus. [Gk. *asparagos*.] A plant grown in gardens for the sake of its young and tender shoots, which form a valuable and well-known article of food. The plants have erect, many-branched stems, and very slender branchlets, which are sometimes mistaken for leaves.

As′pen. [AS. Bot. name *Papulus tremula*.] A species of poplar tree growing in Europe and in Siberia. It has received the specific name *tremula*, from the trembling of its leaves, which move with the slightest impulse of the air. The wood is white, soft, light, and smooth. It is not good for fuel, but is much in use for the turning-lathe, in making troughs, trays, and pails. The bark contains a bitter, alkaloid called salicin, and charcoal made from the aspen tree can be used in the manufacture of gunpowder.

As′phalt or **Asphalt′um.** [Gk. *asphaltos*, bitumen.] A kind of mineral pitch or compact native bitumen, found on the surface and shores of the Dead Sea, which is therefore called Asphaltites, or the Asphaltic Lake. It is found also in Asia, Europe, and America, there being a very extensive lake-like deposit of it in the island of Trinidad, West Indies. It is brittle, and of a black or brown color; melts and burns when heated, leaving no residue.—*Asphaltic cement* is a composition of bitumen, pitch, lime, and gravel, used for forming pavements, and as a waterproof cement for bridges, roofs, etc. It has been of late years very largely used as a paving material in the United States and Europe.—*Artificial asphalt* is prepared from coal-tar, lime, and sand.

Ass. [L. *asinus.*] An animal closely allied to the horse, inhabiting the mountainous deserts of Tartary and other parts of Asia. It is smaller than the horse, and has long ears, an upright mane, a tufted tail, a streak along the back and across the shoulders, and gives a peculiarly harsh bray. The tame or domestic ass is remarkably hardy, patient, slow, and sure-footed, and has become the type of obstinacy and stupidity. The skin is hard and elastic, and is used for covering drums, making pocket-books, parchment, etc. It is of asses' skin that the Orientals make a kind of grained leather called shagreen.

As′teroid. [Gk. *aster*, a star, and *eidos*, form.] The asteroids are a group of very small planets between the planets Jupiter and Mars. Ceres, the first known of these, was discovered on January 1, 1801, the first day of the nineteenth century. Before the last day about 450 had been discovered. Nearly all of these are very small. Ceres is about 1200 miles in diameter, but many of them are only a few miles through. They may be fragments of a former planet, for they occupy the place in the solar system where, by the calculations of the astronomers, a planet should be.

Astrol′ogy. [Gk. *aster*, a star, and *logos*, a discourse.] The name of a system based on the science of astronomy, in which it is claimed that future events, and the coming fortune of any man, can be told from a study of the planets. The early astronomers were all astrologers, and watched the stars in order to predict the future from their movements. Astrology was widely believed only a few centuries ago, but now none but the ignorant have any faith in it, and it is professed only by rogues or fools.

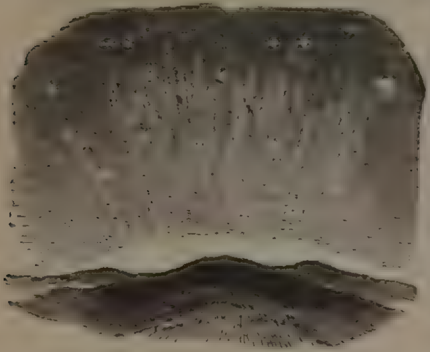
Astron′omy. [Gk. *astron*, a star; and *nomos*, a law.] In its widest sense, it includes everything that is known concerning the heavenly bodies. It treats of their motions, relative positions, distances, magnitudes, mutual influence, constitution, and physical condition. The history of astronomy dates back to very remote ages. The Chinese, Hindus, Babylonians, and Egyptians each possessed some knowledge of the science, and had made some progress in astronomical observation many centuries before the commencement of the Christian era. It was first raised to the dignity of a science among the Greeks. The most eminent among ancient astronomers was Hipparchus, who discovered the precession of the equinoxes and other facts of importance. Ptolemy, the next astronomer of note, founded the system which makes the earth the centre of the universe, around which the mighty circle of the heavens revolves once in twenty-four hours. Copernicus (1473–1543) showed the error of this theory, and made the sun the centre of the solar system, the earth and the other planets revolving around it. The science has been much advanced by Tycho Brahe, Kepler, Galileo, Newton, Herschell, and many others of note, while the instruments of observation have increased in power until the universe has been explored to remote depths and hundreds of facts concerning its constitution discovered. Most marvelous among these are the vast number and immense distances asunder of the stars, and the wonderful discovery, which we owe to spectrum analysis, that our sun, and the fixed stars, which are the suns of other solar systems, are largely or wholly made up of the chemical elements found in the earth—such as hydrogen, iron, and others.

At′mosphere. [Gk. *atmos*, vapor; and *sphaira*, sphere.] The name of the great body of gaseous substance which surrounds the earth. The atmosphere consists essentially of two gases, oxygen and nitrogen, with a small quantity of carbonic acid and some aqueous vapor, with minute proportions of a few other substances. The vapor of water is of much importance in relation to the weather of any locality. The atmosphere being gaseous, obeys the same laws as gases under varying conditions of pressure and temperature. There is reason to believe that its extreme height may be not less than 500 miles, this result having been found by observations on the flight of meteorites. Air being a fluid, exerts pressure equally in all directions. This pressure, or the weight of the atmosphere, at sea-level, is equal to 15 pounds on every square inch of surface. It has been found that the average height of a column of mercury which will balance the pressure of the atmosphere is about 30 inches. (See *Barometer.*)

At′om. [L. *atomus.*] The smallest particle into which matter is considered to be divided. Atoms are inconceivably small, and are supposed to combine into molecules—containing two or more—which form the smallest chemical particles. The atom of each chemical element has a fixed weight, and tables of their weights, as compared with the hydrogen atom, are commonly given.

Au′ger. [AS.] A tool for boring holes, larger than those made by a gimlet. It has a handle placed crosswise, by which it is turned with both hands. The *pod-auger* and the *screw-auger* are the two principal kinds. The former has a straight channel or groove, while the latter has a twisted blade, by the spiral groove of which the chips are discharged.

Auro′ra Borea′lis, [L.] or **Northern Lights.** Luminous appearances which are seen in the northern quarter of the heavens. A muddy appearance of the sky in the direction of the north is the first indication of the approach of the aurora. This gradually resolves itself into a band of a dusky hue, in shape like part of a circle, stretching from the north towards the west, with its ends resting on the horizon, and surrounded by a continuous luminous arch of transparent white tinged with green. The arch is in a state of continual movement, either rising and falling or swaying from east to west, and starting from it, streams of light of brilliant and variegated colors shoot up towards the zenith. The most reliable measurements place the height of the aurora at from 45 to 100 miles above the earth. It is now regarded as certain that there is an intimate connection between the aurora and the magnetism of the earth, this being shown by the fluctuation of the magnetic needle during an auroral display, and also by the fact that the top of the luminous arch is found to be near the magnetic meridian. The aurora has been frequently observed to occur at both magnetic poles of the earth simultaneously. Auroræ are more frequent in North America than in the same latitudes in Europe. Thunderstorms and auroræ are connected with each other—the former being characteristic of the tropics, and the latter of the polar regions. In Norway, Siberia, and Lapland auroras enliven to some extent the snowy landscapes and brighten the long winter evenings, and they furnish much light during the protracted nights at the Arctic region.



Aut′omobile. [Gk. *autos*, self; L. *mobilis*, movable.] A self-moving carriage, distinguished at first as a horseless carriage. Steam and gasoline engines and electric storage batteries are used as propelling powers, and automobiles came rapidly into use near the end of the nineteenth century. A great development of them seems probable in the twentieth century.

Av′alanche. [Fr. from L. *ad vallem*, to the valley.] A vast body of snow, ice, earth, rocks, etc., sliding swiftly down a mountain side or falling down a precipice.

Axe. [AS.] An instrument of steel or iron, with a steel edge or blade, for felling trees, hewing timber, chopping and splitting wood, etc. The handle of an axe is called the helve, the thick metal part the head, and the hole for the handle the eye, and the handle is so fixed in the eye as to be in the same plane with the blade. The carpenter's axe for hewing timber is heavier than the chopping axe, and has a broader and thinner blade and a shorter handle.

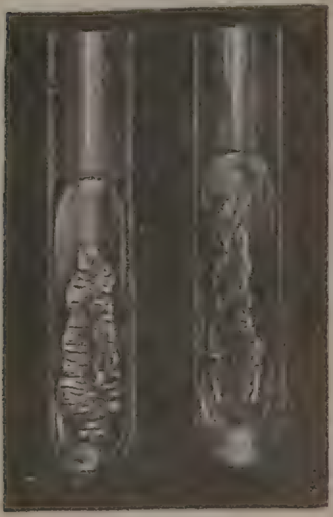
B

Baboon′. [Fr. *babouin*, and *babines*, large lips.] A kind of monkey with a short tail, very fierce and dangerous, and not so often tamed as others of the Monkey tribe. It is found in the hottest parts of Africa and in Siam. Its long snout or lips give its head somewhat the shape of a dog's head. It lives chiefly on fruits, corn, and roots and has large cheek pouches in which its food is kept until needed. The baboons are quadrupeds living on the ground, and running swiftly on all fours, while many of them live in herds, and are formidable to animals and property. The troops are led by patriarchs and guarded by sentinels, and fight fiercely when attacked. There are many kinds of baboon, but the best known are the pig-tailed, the dog-faced, and the mandrill. The nose and cheeks of the mandrill are ornamented with red and blue stripes, and its appearance is made remarkable by other patches of gaudy color.

Backgam′mon. [AS. or Dan.] A game of chance and skill played by two persons on a board with dice and fifteen pieces or "men" each. The board is divided into tables, each table being marked with six points colored alternately white and black. The moves of men are determined by throws of the dice; and if a point is occupied partially or fully by the opponent, the man is set back.

Ba′con. [Fr.] The back and sides of a pig salted. The hair is singed instead of being scalded, and the meat is separated from the shoulder-blade and bones, and cured by salting and drying.

Bacte′ria. [Gk. *baktron*, a rod or stick.] The name of a family of extremely minute plants, consisting of a single cell, and only visible under a high power of the microscope. They are found almost everywhere, and all fermentation and putrefaction are due to them. While the most of them are harmless, and very useful in removing decaying substances, others are highly dangerous to life, forming the "germs" or "microbes" of contagious diseases. This fact was first discovered by Louis Pasteur, and gave rise to the science of Bacteriology. The harmful bacteria enter the body of animals, multiply with extreme rapidity, and give off poisonous products or toxins which cause violent and often deadly diseases. Among these are yellow fever, cholera, smallpox, diphtheria, malarial and typhoid fevers, and various others, also anthrax and other diseases of the lower animals. In the treatment, the use of anti-toxins, prepared by inoculating animals with weakened bacteria, has proved of much service, but the science of bacteriology is so recent that much remains to be learned.

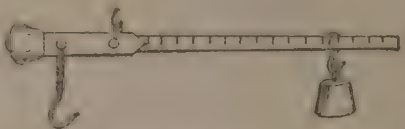

DISEASE GERMS

Badg'er. [Probably from *badge* and *ard*, in reference to the white spot on its forehead.] A carniverous quadruped of the Weasel family. It has a broad, flat body, short tail, and long tapering head. It is a quiet, harmless animal; but when attacked by dogs, turns on its back and defends itself with its teeth and claws. It burrows in the ground with its nose and fore paws, and forms a nest lined with grass and moss, from which it goes forth at night in search of food, which consists of roots, fruits, and small animals. It is found in Asia, Europe, and North America.

Bag'pipe. A musical instrument made of a leather bag, filled with wind by a tube blown by the player. There are other three or four tubes, one a chanter with eight holes. G-clef is the only scale used. It is an ancient instrument, and was known to the Greeks and Romans. It is the national musical instrument of the Scottish Highlanders, and is used in the Tyrol and in other parts of Europe.

Baking-Powders. Chemical substances used instead of yeast in bread-making, their action being to give off carbonic acid gas, which puffs up the dough, or causes the effect called "rising." They are usually composed of tartaric acid and bicarbonate of soda. A chemical action takes place in these in contact with the wet dough, and the gas is given off. Other substances are used, alum being common, though it is thought to be injurious; also acid phosphate of calcium. The use of baking-powders has grown enormously in recent years, and yeast is little used.

Bal'ance. [L. *bis*, double; and *lanx*, a dish.] A machine used for weighing. The common balance consists of a beam supported at its middle point, having two scale-pans of equal weight hung from its extremities. The object aimed at in its construction is to secure delicacy and rapidity in weighing. Of other forms of lever, the Roman balance, or *steelyard*, consists of a rod suspended from a fulcrum, so that the two arms are of unequal length. The substance to be weighed is suspended from the shorter arm, and a moveable weight slides along the longer arm, which is graduated to indicate quantities. This form of balance is in use at railway stations for weighing luggage and loaded carts. The spring balance shows the weight of a body by the extent to which it stretches a spiral spring.



Balloon'. [Fr. *ballon*.] A large bag made of silk, and filled with light gas, coal gas being now generally used. It rises in the atmosphere, because its weight is less than the weight of air which it displaces. A car, supported by a network attached to the balloon, carries the aeronauts; when they wish to ascend more quickly, they throw out some of the ballast, which consists of bags of sand; when they wish to descend, they open a valve at the top, which allows some of the gas to escape. Ascents have been made to determine the pressure and temperature of the air at different heights. In some cases balloons have risen to a height of five miles, and in one instance to seven miles. Balloons have been used as aids in war, and are now being applied in flying machines.

Bal'sam [Arab.] or **Balm** [Gk.] A liquid aromatic substance, of resinous character, which under the name of Balm of Gilead has long been famous in the East for its fragrance and medicinal virtues. It is the product of a shrub growing in Arabia and Egypt. The word balsam, when used alone, now signifies the balsams of Peru and Tolu, a viscid and very fragrant liquid, obtained from two species of South American trees. They are used to flavor confectionery, also in perfumery, and as stimulants and tonics in medicine. Balsam of Canada is the liquid resin of *Abies balsamea*, a species of fir. There is also a genus of trees in the East Indies and Japan known as balsam, of which some species are of great beauty and are widely grown elsewhere. (See *Gums*, *Resins*.)

Bamboo'. [Malay.] This is the giant of grasses. It is a most useful and graceful plant. Its stem is hollow, and at intervals it forms joints or knots; and its flower is enclosed in scales, as in the common grass. It grows everywhere in the tropics—in China, India, and the valleys of the Andes. There are many kinds—the most common being from 40 to 80 feet long, and of any thickness up to 20 inches. Many stems rise from the same root or from the higher joints.

Young shoots contain a sweet pith, and are eaten as asparagus. With the stem the Malay builds his house, and furnishes it with chairs, tables, beds and bedding of the same material. It is made into sails, cables, hats, paper, fishing-rods, pipes, bridges, flutes, handles of tools and weapons, buckets and bottles.

Bana′na. [Span.] The fruit of a tree of the same name, belonging to the same family as the plantain. Its leaves are about 6 feet long, and its fruit grows in great bunches and is a most important food in hot countries. Its fibre is used for shoe-strings and for ropes of all kinds. The banana was probably first grown in the East Indies, but is now much cultivated in the West Indies and in tropical America. Its produce is enormous, being estimated on an acre as 133 to 1 of wheat. A plant of the same genus, in the Phillipine Islands, yields the well-known and very useful fibre named Manila hemp.

Bandan′a. [Hind.] A red or colored silk or calico handkerchief with patterns or white spots. The handkerchiefs are pressed between hydraulic plates with holes or patterns, and the bleaching fluid poured into these holes passes through and produces the spots or patterns.

Ban′yan. [Bot. name, *Ficus Indica.*] The sacred tree of India, and one of the wonders of the vegetable world. It is of the Fig family, and is called the Indian fig. Its seeds carried by the wind or dropped by birds are often deposited in the crowns of palms, and send down roots which become stems, in time taking the place of the palm. These grow to trunks from 60 to 100 feet in height, from whose branches in time, pendulous adventitious roots descend to the ground and in their turn become stems. This process continues until a single tree spreads over acres of ground and becomes a wood in itself. At Nerbudda, India, there is a tree with 354 large trunks and 3,000 small ones, which is inhabited by great numbers of birds, fruit-bats and monkeys, the latter eating the leaves as well as the fruit. The Brahmins of India hold the tree in great reverence, and build their temples in its vicinity.

Ba′obab. A tree of tropical Africa; known also as the monkey-bread tree. Its size is gigantic, and it lives to a great age. Its trunk does not usually exceed 40 feet in height, but its girth sometimes reaches 75 feet. Its branches are from 50 to 75 feet long, and touch the ground. The fruit is abundant, and of the size of a citron, its pulp being pleasant and slightly acid. The juice sweetened with sugar, makes a cooling and refreshing beverage. The bark yields a very strong fibre.

Bar′berry. [L. *berberis.*] A shrub which grows wild in northern Europe and Asia and in parts of the United States. In Italy it grows to the height of a plum tree, and is very ornamental when covered with its bright red berries. These are very sour, but make a pleasant drink, and good preserves and jelly. A fine yellow dye for leather is made from the bark and roots.

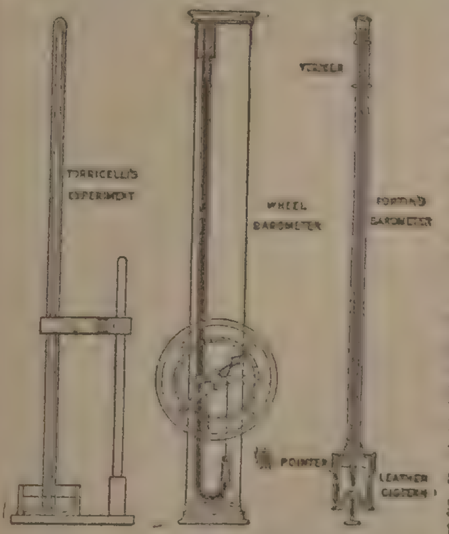
Ba′rium. [Gk. *barys*, heavy.] One of the metallic elements, first isolated by Sir H. Davy, from whom it received its name. It occurs in *heavy spar* (sulphate of barium) and in baryta (a compound with oxygen). Some of its compounds are used in the preparation of fire-works.

Bark. [Dan.] The exterior covering of the trunk and branches of exogenous trees, the endogens and the ferns having no true bark. Some barks are very thin and others thick; those of the giant trees of California are two feet thick. The outer bark protects an inner bark. In many trees the outer bark is coarse, and has no life in it. The inner bark is fresh and full of sap. The sap which goes up through the wood of the tree from the roots to the branches comes down through the inner bark. Bark is useful for dyeing and tanning leather, and certain kinds are made into corks. Quinine is made from Peruvian bark. (See *Cinnamon, Cork, Exogen.*)

Bar′ley. [AS.] A plant of the Grass family, cultivated for its seeds, which are a valuable grain used for food. It is hardier than wheat, maize, or oats, and is grown in northern countries like Russia, Norway, Denmark, Scotland, etc., being found as far north as latitude 70°. Barley is a shallow-rooted plant, drawing its plant-food mainly from the surface layer by curious root-hairs. Barley-meal is used for fattening pigs and cattle, and when boiled, horses also. Barley is mostly used in brewing beer and ale, and in distilling spirits.

Bar′nacle. A genus of ocean animals, called also acorn shells. These belong to the order of the crustaceæ, swim when young, but afterwards attach themselves to rocks, ships, sea plants, etc., develop a shell, and become fixed for life. They gather thickly on the bottoms of vessels in the tropics and much impede their speed.

Barom′eter. [Gk. *baros*, weight; and *metron*, measure.] An instrument for measuring the pressure of the atmosphere. Barometers are divided into two classes, *cistern* and *siphon;* and in each of these classes there are several forms. The simplest form of the cistern barometer consists of the Torricellian tube, with the addition of a graduated scale to show the height of the mercury column. In ordinary weather-glasses, the tube is bent round at the bottom, and the cistern is an expansion of the tube. At the upper end of the tube is a fixed scale of inches, and



tenths of inches, beginning with 27 and ending at 31 inches. A vernier slides along the fixed scale for measuring fractional divisions. In the *siphon* barometer the tube, which is generally of uniform bore, is bent into the form of a siphon, the longer leg of which is closed and the shorter opened. Of the various forms of this class, that known as the *wheel* barometer is the most common for household use. In this the rise and fall of the mercury turns a small wheel, which moves a pointer and dial. The wide sweep of the pointer makes small changes in the height of the mercury very evident. One of the important uses of the barometer is that of measuring the heights of mountains. The pressure of the air on the top of a mountain is less than that at the bottom by the weight of the column of air intervening between the top and the bottom. The difference between the readings of the barometer at the foot of the mountain and the readings on the top gives the means of calculating its height. The most important of all the uses of the barometer is its employment for meteorological observations.—Aneroid Barometer. (See *Aneroid.*)

Barque, or Bark. Any small ship, but especially a vessel, small or large, with three masts, the fore and main of which are rigged as in a ship, but the mizzen is rigged fore and aft.

Bar′rel. A cylindrical receptacle made of grooved staves bound together by hoops, and with heads fastened by dowels. The staves are planed, bent, and grooved by machinery. The name *barrel* includes keg, cask, pipe, hogshead, and butt. Over 1,300 millions of staves are made annually in the United States, chiefly of red and white oak and elm.

Basalt′. [L. *basaltes.*] A rock of igneous origin, occurring chiefly in the ancient trap series of rocks. Basaltic rocks are composed of feldspar, augite, and magnetic iron, and other minerals, such as *olivine.* In color they are blue, brown, and black. They occur both as lava-flows and as sheets or dikes intruded between other strata, and are sometimes found in columns, which may be perpendicular or inclined, and of regular or irregular structure, as at the Giants' Causeway in Ireland.

Base-ball. An athletic game, which takes the place in the United States that cricket holds in England. It is played on a square area, whose corners are called bases. The ball is struck by a bat, and the batsman seeks to run from his station to one or more bases before it can be returned by the opposing players in the field. The party making the greatest number of runs round the complete square wins the game. There are nine players on each side, including the pitcher, batsman, catcher and fieldmen.

Bask′et. The weaving of wicker work is one of the oldest arts known to man. The shoots of the willow or osier are mostly used. Ash, elm, and birch shoots are also used. Baskets are made of a great variety of shapes and sizes, and basket work is used for various other purposes, such as screens, chairs and pony carriages. Boats have been made of basket-work covered by skins, and the ancient Britons used basket shields.

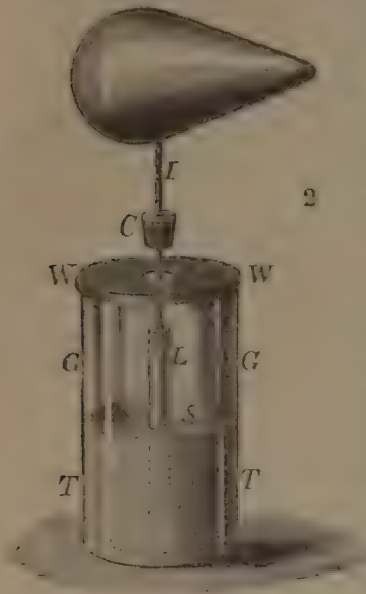
Bass. [A corruption of *barse.*] A spiny-finned kind of perch used for food. There are many kinds, including the black and rock bass and sea bass of America, the common European bass, the striped bass, the white or silver bass of the American lakes, and the brasse or yellow bass. The black bass builds on the bottom a saucer-like nest, where it deposits its eggs, and where, when hatched, the fry are carefully protected.

Bat. [O. E.] An animal with wings of a thin membrane of skin. The finger bones are very long and slender, and the membrane is stretched between them and extends from the arms to the legs. It is filled with nerves, so that blind bats can fly with as much confidence as those that have the use of their eyes. The Bat family is called *Cheiroptera*, or wing-handed animals. They feed on minute insects, and sleep during the day in old ivy-covered buildings, hollow trees or caves. When sleeping the bat suspends itself with its head downwards, and hangs by the curved claws of its hind feet. If it alights on the ground, it has difficulty in taking to the wing; but when hanging it unhooks itself, and its wings are at once free to strike the air. The collared fruit bat of India is from its size and color named the flying-fox, and feeds on fruit. Fruit bats suspend themselves by one foot when sleeping, tucking the other foot under the wing. Vampire or blood-sucking bats inhabit tropical America. They bore little holes in the skin of their sleeping victim, or shave off a piece of skin. (See *Guano.*)

Baths. [AS.] Places for washing in, either for cleansing the skin or strengthening the body. For cleansing, tepid or warm baths are most effective; but being relaxing, they should not be used too often. The cold morning bath, either plunge, or sponge, is very beneficial to healthy persons. Sea-bathing is preferable to bathing in spring water. Turkish baths and electric baths are now in favor among rheumatic patients. Roman baths embraced swimming-baths, warm baths, baths of hot air, and vapor-baths. Other baths, as Russian, mud, douche, etc., are medicinal or of the nature of luxuries.

Bat′tleship. This term refers to a heavily armored ship of war, carrying immense guns, which are placed in revolving armor turrets. One of these ships is like a floating fortress. They differ from the cruiser, which has thinner armor and lighter guns, and is built for greater speed.

Bat′tery, Ley′den. An electric battery, consisting of a number of jars joined together in such a manner that they act like a single large jar. The jars are placed side by side in a box or tray lined with tin-foil, which thus unites their outer coatings with each other and with the ground, while their inner coatings are connected by brass rods, joining together the knots of the jars. They are used to accumulate a strong charge of static electricity. The parts of a jar are: TT tin-foil; SS sulphuric acid; L leaden rod, with upper part I of iron; W wooden cover, closed by the cork C, to keep out the dust when not in use.



Bay′onet. [Fr. *bayonnette.*] A sharp, straight, tapering steel pike or sword, capable of being fastened to the muzzle of a musket or rifle. It is named from Bayonne in France, where the first was made about 1640.

Beads. [AS.] Perforated balls of glass, porcelain, or gems worn for ornament; also a small ball for counting prayers. The glass houses of the island of Murano, near Venice, have been, from a remote period, a centre of the manufacture of glass beads. Upwards of five thousand people are there employed in this industry. Beads are much used for fancy work. "Bugles," or long beads, were formerly used, but now jet beads are common for trimming ladies' dresses.

Bea′con. A signal fire, or an erection at the entrance of a river or harbor, to give warning of dangerous navigation. Beacon fires are of great antiquity, and by their use news were quickly flashed from hill to hill across a wide area. Iron pots to hold the beacon fuel were often placed in church towers.

Beak. The point of anything; the bill of a bird. The beak is a conspicuous feature in all birds, and consists of an upper and lower half. The upper half is commonly articulated with the skull in a more or less immovable manner. The parrot possesses this feature in its greatest perfection, but it exists in a less complete form in many birds. In no recent birds are teeth ever developed, though rudiments of teeth have been recognized in some parrots, and fossil birds have been found with well-developed teeth. The beak of each bird is beautifully adapted to its habits. Beaks of land-birds are hard and horny—in the woodpecker like ivory. In many water-birds the beak is rather of a leathery texture. The beaks of birds of prey which feed on flesh are strong, hooked, and pointed, those of herons and storks, which feed on fish, are long, pointed, and sharp; the beak of the parrot, which feeds on nuts, is adapted to crushing the shell and picking out the kernel; the beak of the duck is flat and broad, with comb-like fringes on the upper jaw which fit into the lower jaw. In the puffin and similar birds part or the whole of the horny sheath is annually shed.

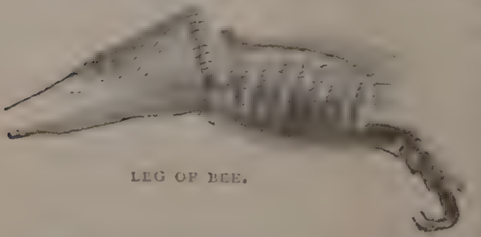
Bean. [AS.] The seed of various pod-bearing plants used for food. The two principal field beans are the Scotch or horse bean, and the tick bean. There are also many varieties of garden beans, such as the long pod and broad windsor. The bean is a valuable source of food for men and the domestic animals and is grown in most of the temperate climates of the globe, being used as human food in its unripe state and as food for animals when ripe. French or kidney beans are grown for the green pods. Haricot beans, which are almost the same as French beans, are largely grown in France and Italy. The Lima bean is a variety of the pole-bean.

Bear. [AS.] A large carnivorous animal, with a rough, shaggy coat and a peculiar gait. It walks on the sole of the foot (plantigrade.) It has five toes on each foot, and when fighting stands nearly erect on its hind feet, and strikes with the fore paws or clasps its antagonist forcibly. Though a flesh-eater the bear prefers vegetable food, and is fond of the fruit and roots of trees. Most bears are good climbers of trees. The bear partially hibernates, the female shutting herself up when with young, and being without food until the following spring. The brown bear of Europe and Asia is sometimes exhibited as a performing animal. There are also the black bear and grizzly bear of North America, the sloth bear of India, the Syrian bear of Scripture, and the polar or white bear, which, with its yellowish fur, lives among ice, and is a good swimmer, and preys on the seal and walrus. The ant-bear, the sea-bear, etc., are not real bears, but belong to quite different orders of animals.

Bea′ver. [AS. L. *fiber.*] An interesting rodent animal, valued for its fur. Formerly abundant in North America, it is now scarce, and found only inhabiting the banks of rivers in wild parts. The hind feet are webbed for swimming, and it has a curious broad tail, flattened like a paddle, which is used as a rudder. It builds lodges of branches and mud about 3 feet high and 7 feet in diameter, and is very sagacious in making a dam or artificial bank of wood, stones and clay, to protect the lodges. The entrances are at all times beneath the water, so that the animal can enter or leave its home in safety. Its powerful teeth are its chief tools, and it cuts down trees of great size by gnawing a groove all round, so that they fall as it desires, and it then cuts them into lengths. The food of the beaver is the bark of trees, and it lays up a store for winter by cutting branches and sinking them under water, placing stones on them. The fur of the beaver was formerly used for hat-making, but is now used for trimming ladies' cloaks and for gloves; and the material called castor is obtained from two small bags in the groin of the animal.

Bed. [AS.] Something to rest or sleep on. Many substances have been used for this purpose, such as skins, heath and rushes, straw, etc. Feathers have long been used. The East Indians lie on the floor on light mattresses, the Japanese on matting, the Chinese on low bedsteads. In Europe, bedsteads are used with two mattresses—the upper being made of hair or down, and the lower of cotton. The best beds are made with steel springs, covered with a hair mattress. These are coming largely into use, for hygienic reasons, the feather bed not being conducive to health, while the close bed-curtain has been generally discarded. Folding beds, which by day look like a desk or other article of furniture, are now much used.

Bee. [AS.] A family of membrane-winged insects, of which the best known are the honey or hive bee and the humble or bumble bee. The hive bee is a busy and curious honey-gatherer, which lives in communities or colonies. A colony consists of males or drones, females or queen bees, and workers. A hive of forty or fifty thousand busy workers is all under one queen bee. She lays all the eggs, and the workers keep close guard over her. They also are females, but as a rule lay no eggs. The drones have no sting, and neither work nor defend their nest. They number about one-thirtieth part of a hive, and are all slaughtered by the workers during the latter part of summer. When well kept, bees collect more honey than is necessary for themselves and their young, and the excess is the honey used by man. The queen never works, but the workers gather the pollen and nectar from various flowers. (See *Honey.*) They have the sense of smell, for they scent the nectar or honey at great distances; and, like other insects, they have curious compound eyes, composed of thousands of small eyes. The mouth of the bee is well adapted to the work. It has a long lip and a much longer tongue. With the latter it probes the flower-cups and licks up the nectar which in its honey-bag becomes honey. In the hive, bees gather in thick clusters, hanging from the top, the first suspended by its fore claws, and the others holding to one another by the legs. In twenty-four hours small scales of wax appear on their under parts. The workers shake the wax from their bodies or pick it out of their pouches with their feet; they then take it in their jaws, work it over with saliva, and from it build cells in double rows. These cells are called the honeycomb. Artificial wax combs are sometimes used, and the bees fill them with honey. Pollen is also gathered for bee-bread. The worker scrapes the pollen and packs it into little baskets at the middle joints of its hind legs. Bee-bread is pollen mixed with honey for ordinary food and to feed the young. Cells are hexagonal in shape, and so have strength and economize space. The cell of the drone is larger than the cell of the worker, and that of the queen bee is larger than either. The queen bee places a single egg in each cell—worker-eggs in worker-cells, and drone-eggs in drone-cells. The workers seal up these cells, leaving little holes for air to enter when the young shall be hatched, while honey-cells are always sealed tight to keep out the air. The eggs become grubs or larvæ, which spin about themselves silken cocoons, and in twenty-one days after the eggs are laid, full-grown bees, both workers and drones, come forth. The queen grubs remain still in their cells, and are guarded and fed by the workers. The old queen, jealous of these royal prisoners, becomes excited, and a large number of bees fill themselves with honey, and, joining the old queen, "swarm" or leave the hive, and settling on some branch, are put into a new hive.

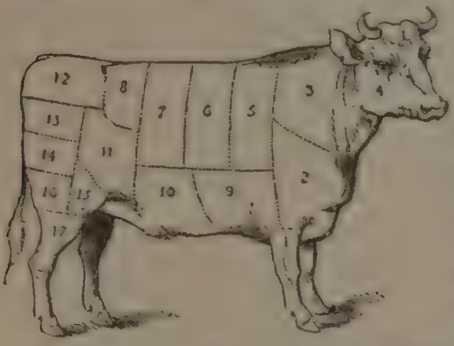

LEG OF BEE.

The *humble-bee* (L. *Bombus*), having a longer tongue than the honey-bee, reaches the nectar of the red clover flower, and, carrying pollen from stem to stem, enables it to bear seed. The New Zealand farmer tried to raise clover, but failed till humble-bees were imported. The humble-bee and wasp have communities like the honey-bee, but the number of the males equals the females, and the males work actively and defend the nest. Bees fortify their nests against the sphinx moth and other enemies.

The *carpenter bee* is a solitary bee. She bores her nest in old wood in the shape of a tube, which takes a sudden turn and is continued down the trunk parallel to the grain of the wood. This tunnel she divides by sawdust partitions into cells, in each of which is placed an egg with a supply of food for the young larva. Large quantities of bees-wax are used for making candles, and also for artificial flowers and fruit.

Beech. [AS.] A tree of the *Fagus* family, growing in Europe and America to a large size. It has a smooth bark and thick foliage, and bears triangular nuts which yield an oil. These nuts are used to feed swine. The wood is made into shoe lasts, mill wheels and tool handles.

Beef. [Fr.] The flesh of an ox or cow when slaughtered for food. Beef contains fibrin and albumen, which are good flesh-forming materials, and the value of meat is chiefly due to the presence of these two substances. The methods of cutting up an ox into beef vary in different countries. In this country it is cut up into 17 parts—(1) shin, (2) clod, (3) neck, (4) cheek, (5) chuck rib, (6) middle rib, (7) fore rib, (8) sirloin, (9) shoulder, (10) brisket, (11) thin flank, (12) rump, (13) aitch or edge bone, (14) buttock or round, (15) veiny, (16) mouse buttock, (17) leg. Corned beef is made by soaking lean parts in a pickle of saltpetre and sugar.



Beer. (AS. *beor;* Ger. *bier.*] Under this name may be included beer, ale, and porter. The process of making beer is called brewing. Barley is soaked in water and kept in a warm place until it begins to sprout. During this process the starch in every grain of barley is changed into saccharine or grape sugar. The sprouting is stopped by drying the grains, and the barley is then called malt. This done, the malt is crushed and boiled in hot water, which dissolves the sugar. The sweet liquid so got is called wort. Hops are added to the wort. They give an agreeable taste to the beer and help to clear it and to keep it. Next a little yeast is added which causes it to ferment. Fermentation converts the grape sugar into carbonic acid gas, which escapes into the air, and alcohol, which remains in the beer. In 100 lbs. of beer there are from 4 to 8 lbs. of alcohol, 4½ lbs. of dextrin, ½ lb. of albuminoid matter, and from 80 to 90 lbs. of water.

Beet. [AS.] A biennial vegetable plant which produces an edible root the first year and seed the second year. There are many varieties; the red is used for the table, the mangel-wurzel for feeding stock, and the white in making sugar. Beet-root sugar is equal to that made from the cane, and is made in immense quantities in Europe, where more than 4,000,000 tons are produced annually. This industry has been introduced into the United States, but has as yet made no great progress.

Bee'tle. [AS.] Any insect of the order *Coleoptera* (or wings in a sheath), having four wings, the outer pair being stiff cases for covering the others when folded up, and defending them from hard substances underground. The black beetle is the common large cockroach. The curculio or weevil lives on fruit or grains; tiger-beetles are striped; carrion-beetles live on dead animals; the Spanish-fly is a bright-green beetle; stag beetles have long jaws. The turnip-fly or flea-beetle and click-beetle are destructive to crops. There are many thousands of different species of coleoptera, and they vary very much in size and appearance.

Bego'nia. [From Michael Begon, a botanist.] A species of plants grown as ornamental plants. The leaves are curiously one-sided and often exhibit brilliant colors.

Bell. [AS.] A hollow metallic vessel shaped like a cup, with a wide mouth containing a clapper or tongue, and giving forth a musical sound when struck. Bells are made of various metals, but the best are made of an alloy of copper and tin. The large bell of Moscow is 19 feet 3 inches high; the bell of Kioto, Japan, is 24 feet high.

Belladon'na. [Bot. name *Atropa belladonna.*]. A herbaceous plant with reddish bell-shaped flowers and shining black berries. Both plant and fruit are poisonous, and used as powerful medicinal agents. Also called *nightshade.*

Bel'lows. [AS.] A flat, round, double utensil, which by the rise and fall of the top part draws in air through a valve and expels it through a tube. Useful for blowing fires, ventilating mines, and filling the pipes of an organ and some other musical instruments with wind.

Ben'zene. [Arab. from *benzoin.*] A compound of carbon and hydrogen discovered by Faraday. It occurs amongst the products of the distillation of many organic bodies, but its chief source is coal-tar. It is a thin, limpid, colorless liquid, emitting a pleasant odor. It dissolves easily in alcohol, ether, turpentine, and wood spirit, but is insoluble in water. It is of value from its great power of dissolving gutta-percha, wax, camphor, and fatty bodies. Impure benzene is used for removing grease stains from silk or woollen articles of dress.

Ben′zine. A substance derived from petroleum, which is much used as a substitute for turpentine and for dissolving oils and fats.

Ben′zoin. [Arab.] A vegetable substance obtained by drying the juice of the benzoin tree. It is brought from Siam and the islands of the Indian Archipelago. It is used in perfumery and as incense, being fragrant and aromatic, and also in medicine. A compound tincture is prepared from it, known as Friar's Balsam, and is used for dressing wounds.

Berg′amot. [It. *bergamotta ;* prob. from Turk. *beg armudi*, a lord's pear.] A tree of the Orange family, having a pear-shaped fruit, from the rind of which is extracted an essential oil with a delicious and much-prized perfume called oil of bergamot. This oil is used in perfumery and in making liqueurs.

Ber′yl. [Gk. *beryllos.*] A mineral found in granite together with topaz. It is of a light-green color. It crystallizes in six-sided prisms; is very hard and difficult to fuse unless mixed with some other substance, such as borax; and consists chiefly of alumina, silica, and glucina. It is found in India, Brazil, Peru, and Siberia.

Be′tel. [Tamil.] A climbing pepper, the leaves of which, mixed with lime and areca-nut, are chewed by the inhabitants of the East Indies, and the Malays. It stains the lips red and teeth black.

Bevel Wheels. Wheels the axes of which are not parallel, but inclined at a certain angle to one another. When the axes of the two wheels are at right angles they are called *mitre wheels.*

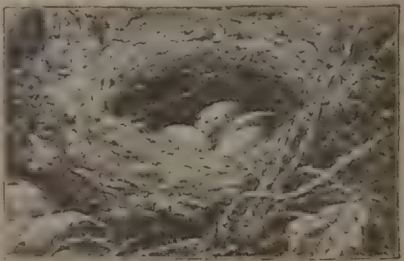
Bi′cycle. [L. *bis*, twice; and Gk. *kyklos*, a circle.] A two-wheeled velocipede propelled by treadles attached to cranks or levers. It has become a favorite vehicle, both in Europe and the United States, from its rapidity of motion and the ease with which it can be propelled.

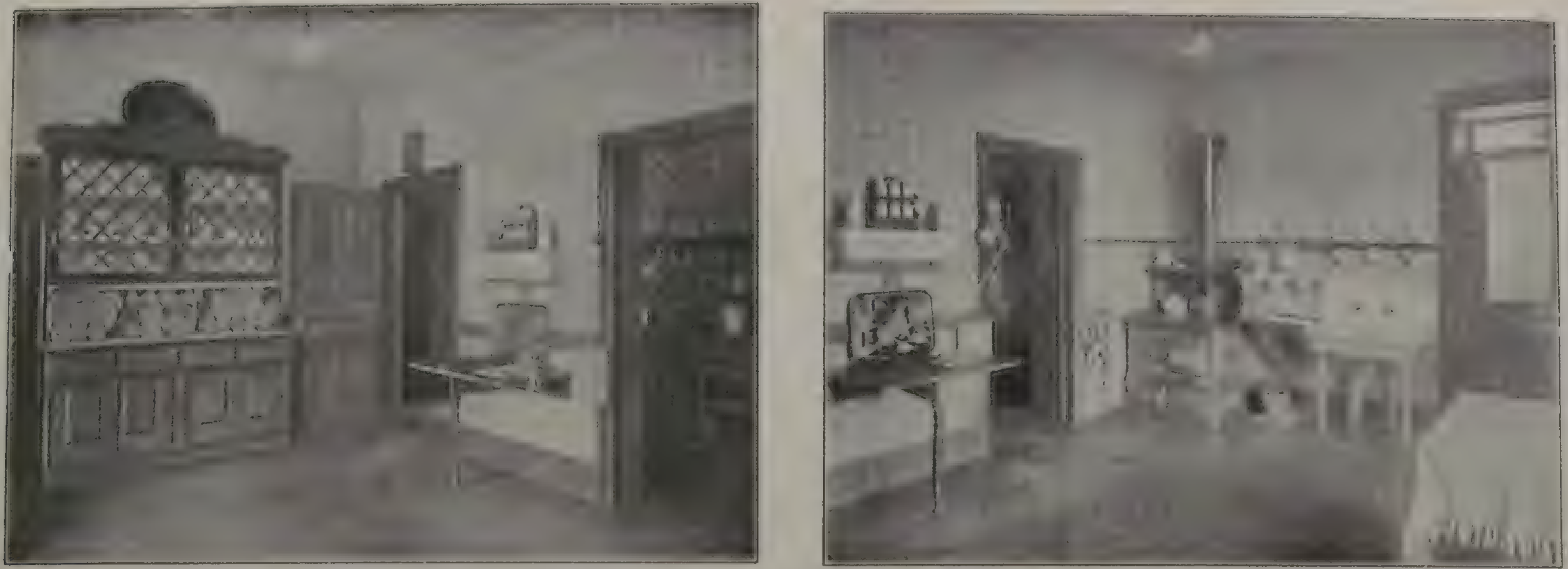
Bill′iards. [Fr.]. The king of indoor games. It is played with balls and a cue on a table, with pockets at the sides and corners. The player seeks to impel his ball to strike or cannon two other balls, or drive another ball into the pockets. The French game is cannon only, and is played on a table without pockets. The American game is played with four different colored balls. Pyramids is played with fifteen red balls arranged in a triangle, and a white ball; in pool there are as many balls as players.

Bi′ograph. [Gk. *bios*, life; *graphein*, to write.] An instrument for the reproduction from photographs of seemingly living forms. The photographs are taken on a film in such rapid succession that every phase of movement of the figures is caught as a separate picture. To produce the effect of life the film with its successive pictures is run rapidly through a lantern arrangement, they being thrown on a screen in such quick succession that they blend to the vision and produce a remarkable vivid representation of actual life movements.

Birch. [AS.] A tree of several species belonging to the genus *Betula*—as the white or common birch—the most widely diffused, the dwarf birch, the paper or canoe birch, the yellow birch, and the black or cherry birch. The common birch is called silver birch or lady birch; it has small green leaves, elegant drooping boughs and silver-white bark, and grows on the bleak mountain side. From the bark of the common birch an oil is obtained which is used in the preparation of real and imitation Russian leather; also a resinous substance called birch camphor or betulin is got from the outer bark of the tree. The birch of Jamaica is a kind of turpentine tree. The dwarf birch is a mere bush, and is the last shrub found on drawing near the eternal snow of the pole. Dye is prepared from birch leaves; and the wood makes good charcoal for gunpowder, and is used for smoking hams and fish. The wood is used by cartwrights, upholsterers, and turners; and the bark being impervious to water, is used for canoes and for preserving roofs. An oil similar to winter-green oil is prepared from the black birch.

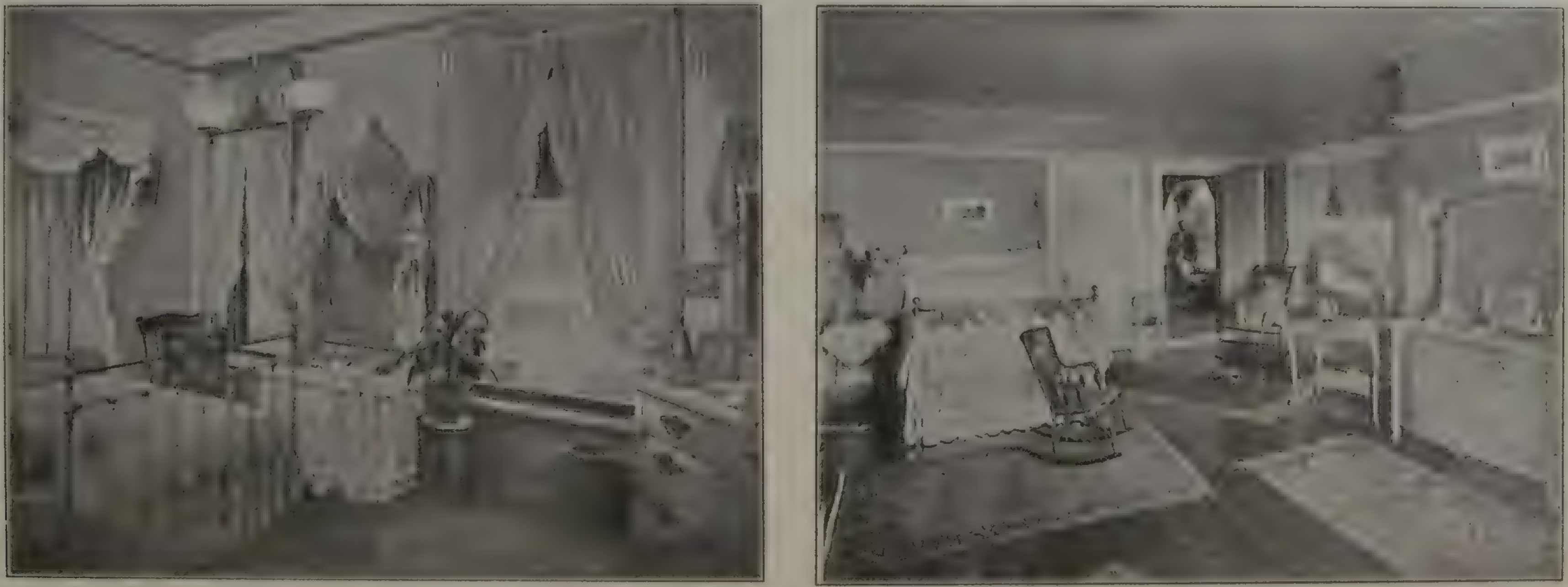
Bird. [AS.] A winged vertebrate animal covered with feathers. Birds easily mount up into the air, their bones being of all animals largest in proportion to their weight, and the quills of their feathers filled with air. These communicate with a series of sacs or air-chambers connected with the lungs. In birds which fly much the neck is stretched forward like a wedge, the breast bone is extended like the keel of a ship, and the wish-bone, which is the collar-bones joined into one, is much developed. In birds such as the ostrich, which run chiefly, the wish-bone does not grow. When a bird perches and bends its knees, the weight of its body pulls a large ribbon-like cord in its leg, which makes its toes clutch the perch. As it sleeps its body falls forward; and the further forward it goes, the closer do the toes cling, so that it does not fall off. The heart of a bird has four chambers, with perfect circulation. The temperature of the blood of birds is very high (104°) while that of the human body is 98°. Their bodies retain this heat through the non-conducting nature of the down and feathers with which they are covered. Feathers (*q. v.*) are modified hairs, and are shed annually. Birds are then said to moult. The bones of the neck vary in different birds. The sparrow has nine, the swan has twenty-three.





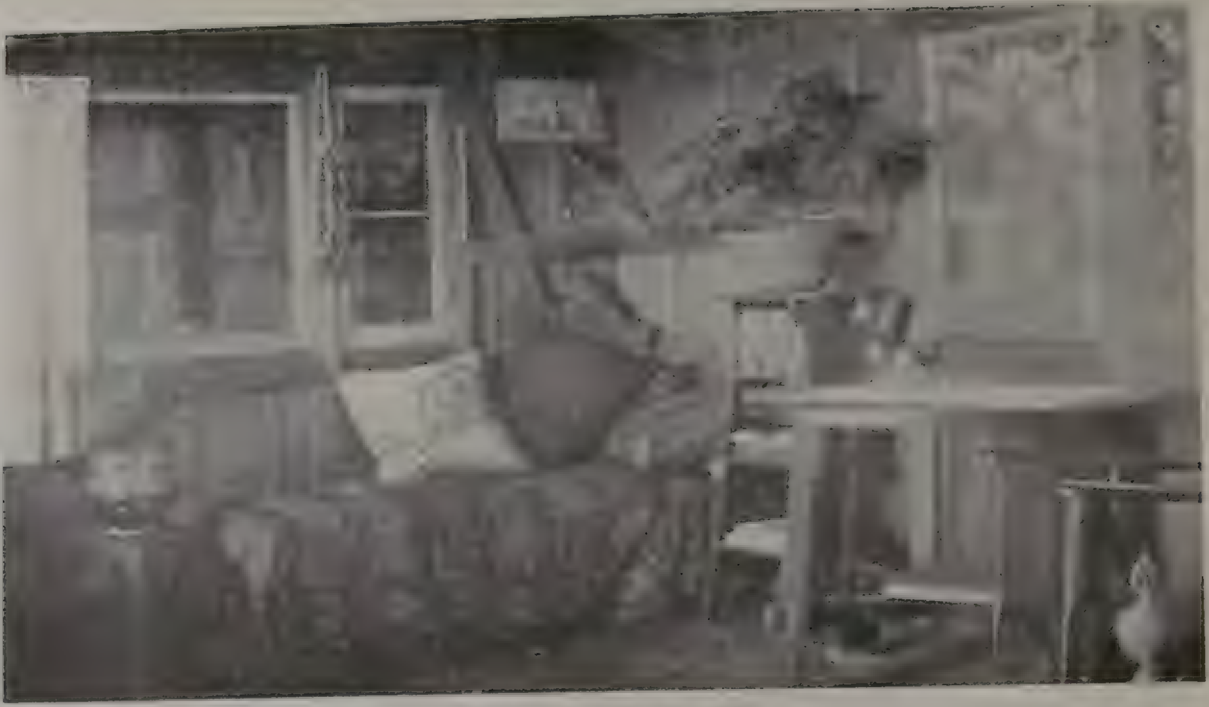
A MODEL KITCHEN

The two views show a model kitchen arranged for convenience—for health and economy. The floor covered with oil cloth or tiles, the walls papered or painted, **plumbing easily accessible, pantries and cupboards ample—range of the latest pattern, and sinks with hot and cold water.**



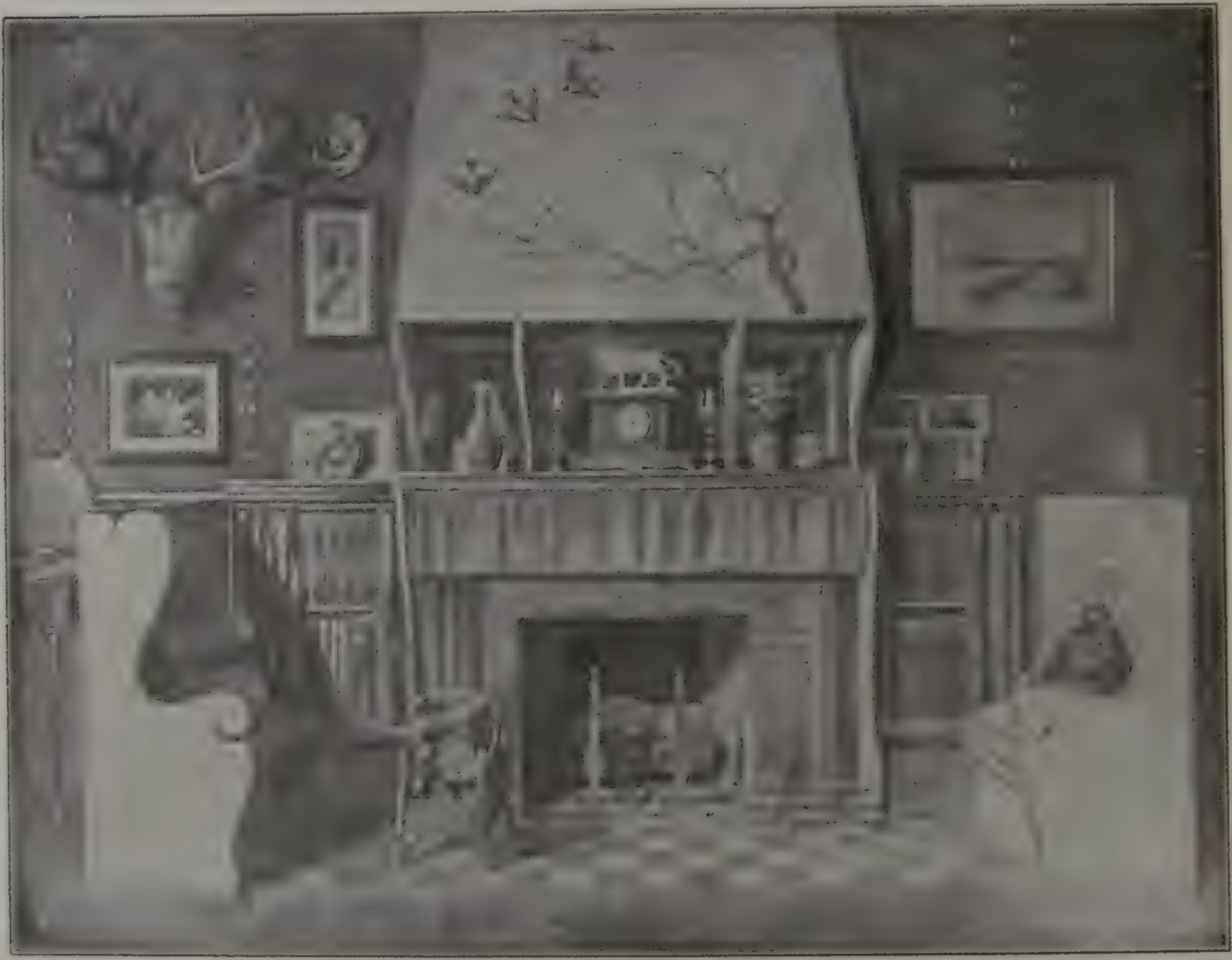
BEDROOM FURNISHINGS

The bed-room at the left is a suggestion for a room furnished in blue and white. The walls may be hung with satin striped paper. The draperies may be easily made and artistically arranged. The room at the right looks out upon a balcony. The bedstead may be of brass, the furniture of birds-eye maple, bedspread and bureau cover may be trimmed with lace. The floors may be covered with rugs, and walls tinted.



HOME DECORATIONS

A comfortable cozy corner, which may be made in any house at small expense by a rearrangement of the furniture or by a boy or man familiar with tools. The sofa is of rough wooden construction, covered with a mattress and a rug or shawl.



HOME DECORATIONS

The Ingle Nook and Mantel. A suggestion for beautifying a room where there is a fire place and mantel and space at each side for artistic seats and cushions. The whole effect is that of warmth and comfort. A few choice ornaments are on the mantel, handy volumes on the shelves and pictures on the wall.

The necks of birds are thus flexible and strong, and their heads may be turned easily, or put under their wings when they go to sleep. The back-bone of a bird is inflexible, and practically one bone. The place of teeth in animals is taken in birds by the horny growth called the beak (*q.v.*) Tropical birds have the most beautiful plumage. Birds usually migrate in flocks to warmer countries on the approach of winter, returning in spring, many of them being very swift in flight. All birds build nests in which their eggs are laid and their young hatched, the young being cared for in the nest until able to fly. Birds' nests are made of a great many different materials—such as straw, sticks, hay, moss, leaves, clay, wool, hair, and feathers. The outside of the nest is rough and strong, for it has to keep out the wind and the rain. The inside is generally soft and warm, like a bed. The nests of different species of birds vary greatly, from the neat little nest of the wren, with a hole in the side for an entrance, to the hole in a tree in which the woodpecker lives, the swallow's nest of dry mud, and the eagle's nest of woven sticks. Some birds build their nests in trees, some in bushes, some in hedges, some among the grass of the field, and some in the corners of windows and under the eaves of houses. Birds are classified according to their beaks and claws, which vary greatly with their habits. There are swimmers, waders, runners, scratchers, climbers, perchers, and birds of prey. (See *Beak*, *Claw*, *Feather*, *Foot*, *Wing*.)

Bird of Paradise. A perching bird allied to the bower-birds. It has wonderfully beautiful plumage and remarkable tail-feathers, which are much prized for ladies' hats. There are twenty kinds. They live only in New Guinea and the adjoining islands.

Bis′cuit. [Fr. *bis cuit*, twice baked.] Originally biscuits, which belong to the class of unfermented bread, were deprived of their moisture by being twice baked; but although that process is no longer employed, the name is retained. Ship biscuits are made of wheat flour, from which only the coarsest bran is separated. Fancy biscuits are made from fine flour, to which eggs, are added with ginger, almonds, or other spices. (See *Bread*.)

Bis′muth. [Ger.] One of the metallic elements. It is found in small quantities, in the native state, in Cornwall, France, Germany, Peru, and Siberia, but is chiefly prepared from its ores, which are found in Saxony and Cornwall. Pure bismuth crystallizes more readily than any other metal, and its density decreases under increased pressure. Fusible alloys containing bismuth have been to some extent used as safety-plugs for steam boilers, in addition to the safety-valve. The compounds of bismuth are also used in medicine and as pigments.

Bi′son. A large animal of the Ox family, of which only two species remain, one in America and one in Europe. Its most striking difference from the ox is in the hump behind the neck, the longer limbs and shaggy head and shoulders. The American bison, commonly but wrongly called buffalo, was formerly very abundant, but has been nearly exterminated. Of the European bison only one herd remains. The bison is about 10 feet long, 6 feet high, and is very strong.

Bit′tern. A wading bird of the Heron family, now very scarce in England. It has a *booming* cry, which when heard at night sounds so dismally that the bird has been named the night raven. The American bittern is called the stake-driver or meadow-hen.

Bitu′men. [L.] A combustible mineral which emits a strong odor when burning. It is supposed to have been produced by the action of heat on coal, and is essentially the same as petroleum and naphtha.

Black′berry. The fruit of the prickly bramble bush, called in England the brambleberry. The plant is of the same family as the raspberry. It grows all over Europe and Asia, and is abundant in North America. In the United States are the high-bush and low-bush blackberries, and the creeping dewberry, all growing wild. There are also several cultivated varieties, bearing larger and finer berries. The fruit is eaten for dessert, made into jelly, jam, and preserves, and wine and brandy are made from it.

Black′bird. A singing bird which is a species of thrush. In England it is sometimes known as the merle, and its fine note makes it a favorite; but not with the gardener, who blames it for its fruit-eating propensities. In America there are the crow-blackbird or purple grackle, the red-winged blackbird, and the cow-bird.

Black-lead. The substance called by this name has no lead in its composition, but consists of graphite or plumbago, one of the forms of carbon. It gets its name from the mark it makes on paper, like that made by lead. The best known is found at Ticonderoga, New York, this being of almost pure carbon. It is used to make lead pencils, being ground and compressed into shape. It is also used for stove blacking, mixed with clay to form crucibles, which have to stand great heat, and for other purposes.

Black-snake. A species of snake common in the United States and one of the largest found there, measuring sometimes over six feet in length. It is of a leaden color, is very swift in its movements, and readily climbs trees. Though it bites readily, it is not poisonous, and is an enemy to the rattlesnake, which it coils around and crushes to death. It feeds on small animals, seeks eggs in the poultry-yard and milk or cream in dairies. It is easily tamed.

Blank′et. [Fr.] A heavy, loosely-woven stuff, usually of wool, and having a nap, used in bed-clothing, as a robe, or as a cover for a horse.

Blast-furnace. A furnace for smelting ores into which air is forced by pressure. The terms *hot blast* and *cold blast* are used to indicate whether the current is heated or not heated before entering the furnace.

Blast´ing. The blowing asunder of rocks or other hard material by means of explosives. In this work gunpowder is now largely displaced by the more powerful dynamite or other newly-discovered explosives. Blasting holes are now largely made by steam-drills instead of by hand, and the electric spark is much used in exploding the charge. Some of the new explosives are exceedingly powerful in their rending effect.

BLAST FURNACE.

Bleach´ing. [Fr.] The process of removing the color from textile fabrics and from many other materials used in the arts, such as oil, wax, and the various substances used in paper-making. The old method of bleaching was carried on by exposing the materials to the action of the sun's rays, while they were kept damp by frequently sprinkling them with water; but since the discovery of the bleaching action of chlorine about one hundred years ago by Berthollet, a French chemist, bleaching has become a thoroughly scientific process. The two chief bleaching agents are bleaching-powder (or chloride of lime) and sulphurous acid.

Blood. [AS.] The vital fluid of animals, which circulates through tubular vessels known as arteries and veins. This fluid is largely water, but contains the nutriment derived from the food we eat. The arteries carry the bright-red blood which feeds the system. The veins bring back dark-colored blood, filled with waste substance from the body. Arterial blood is bright red and life-giving. Venous blood is black looking, and destructive of life until purified by the lungs (*q.v.*) From the extremities of small arteries the blood enters the thread-like capillaries, where nutrition takes place. These capillary tubes convey the blood to every part of the muscles and bones, to the root of every hair and every part of the brain, and throw it into the veins, so that it may go back to the heart (*q.v.*). Blood, though red in appearance, is a clear liquid without color, in which are particles or corpuscles so minute that the aid of a powerful microscope is required to examine them. Some corpuscles are red, others are white, but the red are so numerous as to tinge the fluid red. Oxygen from the blood unites with particles of tissue, and burns them, causing both the heat and the motion of the body. Exercise makes us warm, because the air is inhaled more rapidly, and the blood passes more rapidly through the lungs in contact with it, and so more oxygen is introduced into the body. The blood circulates through the body once in about two minutes, or about 12 lbs. of blood pass through the heart every minute. Every time the heart contracts it sends a fresh supply of blood to the blood-vessels, and the motion gives a pulsation to the system. This is distinctly perceived at the pulse in the wrist, because there a rather large artery lies near the surface. The temperature of the human body is 98°, that of birds is 104°, and that of fish is 85°.

Bliz´zard. A winter storm common on the western plains of the United States, its characteristic being a strong and very cold wind and fierce blinding snow. It usually appears in the Canadian plains, following a very low barometer, and spreads over a wide area. Blinded by the snow, many people lose their lives. In the blizzard of January, 1888, about 235 people perished. Blizzards rarely visit the East, but on March 12, 1888, one occurred in the country about New York and Philadelphia which made all roads impassable and stopped railroad travel for nearly a week.

Block-system. A system for the control of railroad trains so as to avoid collisions. Block stations are placed a few miles apart, connected by telegraph lines, and provided with signal boards or lights. The rule is that no train shall pass a block station while a train is on the section in advance, and until word comes back that the section is clear. Thus, if operated perfectly, there can be only one train on a section of three or four miles at a time, and collisions would be impossible. But men are not always to be trusted, and an automatic block system, in which the trains themselves work the signals, through electric attachments, is being introduced. The block system was first introduced in 1851, and is now much more common in Europe than in the United States.

Blow´pipe. A tube for blowing a jet of air into the flame of a lamp, a fire, or a gas-jet, in order to obtain a high temperature by rapid combustion. It is used in glass-blowing, in soldering metals, and in analytical chemistry and mineralogy.

Blue´bird. A small song-bird very common in spring in the United States. It lays five or six pale-blue eggs, and hatches several broods in a season.

Blue´fish. A large voracious fish, valued for food, and widely found on the American coast. It is called there the horse mackerel.

Bo´a Constrict´or. [L.] A large and powerful serpent of tropical America, sometimes twenty or thirty feet long. It has a succession of spots, alternately black and yellow, along the back. It kills its prey by winding it within its folds and crushing it by its muscular strength; but other serpents in Asia and Africa which crush their prey are also sometimes called by this name.

Bob′bin. [Fr.] A spool or reel, of bone or wood, with a head at one or both ends, and a hole bored through its length. It is used to hold yarn or thread in a shuttle, as in spinning or warping machines, looms, and sewing-machines. Bobbin lace is made on a pillow with bobbins.

Bod′y. [AS.] The material part of a living being. In the higher animals it is composed of a *head*, a central part or *trunk*, and four *limbs*. When the human body is dissected, or taken to pieces, there is found a hard part or skeleton, composed of about 240 bones; upon these bones lie masses of red flesh (muscles), by which the bones are moved; on the outside of all is a covering called the *skin*. The limbs are solid, but the trunk and head are hollow, containing certain organs, each of which has its allotted duty or function to perform so long as the body retains life. The muscles are called the organs of locomotion, because it is by their aid that we move about from place to place. The chief organ in the head is the *brain*, contained in the bony box called the skull. The trunk is divided, horizontally, into an upper portion (called the *chest*) and a lower portion (known as the *abdomen*). The organs within the chest are the *heart* and the *lungs*. In the abdomen are situated the *stomach*, the *intestines*, the *liver*, the *pancreas*, the *spleen*, and the *kidneys*.

Blow′ing-mach′ine. An apparatus to produce a blast of air. The blacksmith's bellows is one of the earliest forms of these. Various machine-blowers are now in use, which give a very powerful blast, some of them being rotary machines, others utilizing the steam jet to produce a blast. Another form of blower is the electric fan, with rotating vanes, used to keep the air in motion in stores or offices. Powerful fans are used for the melting of iron in cupolas, and air blasts are turned into smoke-stacks to make a powerful draft for locomotives, steam fire-engines, etc.

Boar. The wild form of the common hog. It is a large and strong beast, of four feet or more in length, while the male has dangerous canine teeth. It hides by day and roams at night, doing great damage to crops and young trees. It is hunted on this account, and also for its flesh and bristles, but often proves a dangerous enemy. In some parts of India "pig-sticking" is the favorite sport.

Bog. A tract of land covered with peat, which holds much water and converts it into a kind of quagmire. It is sometimes called Peat-bog, Peat-moss, or Moss, to distinguish it from other kinds of swamp. Bogs of wide extent occur in Northern lands and they cover a considerable part of Ireland. Some bogs are more than 40 feet in depth, and are dangerous to traverse in wet seasons. (See *Peat.*)

Boil′er. A vessel in which water is boiled to produce steam, for engine purposes. It is usually a large, cylindrical receptacle of iron, though boilers are frequently made of tubes, where rapid steam-making is desired. The boilers in use to warm buildings are commonly made of wrought iron, though copper is sometimes used.

Boom′erang. A peculiar missile used by the savages of Australia in war or the chase. It consists of a piece of hard wood of a bent form and about two feet long. One side is flat, the other convex in shape. When thrown it has a singular motion. Instead of going forward it rises with a whirling motion, then begins to go backward, and strikes the ground behind the thrower. The Australians are very skillful in the use of this singular weapon, and can make it strike where they wish.

Boil′ing. When water or any other liquid is heated in the open air, its temperature rises. After a time bubbles of vapor are formed and reach the surface, and at this stage boiling or ebullition has begun. The heat converts the water from the liquid state into the state of gas or vapor, which rises in bubbles and passes off into the air as steam. The temperature at which boiling begins is called the *boiling-point*. Different liquids have different boiling points,—that of water being 212° F.; of alcohol, 173.12°; of mercury, 662°; and of acetic acid, 243.14°. These are the temperatures needed at sea-level. At higher points, where the pressure of the atmosphere is less, the boiling point is reached at lower temperatures.

Bolt. [AS.] A strong pin of iron or other material used to hold something in its place, often having a head at one end and a screw thread cut on the other, on which a movable piece called a nut is screwed.

Bone. [AS.] A firm, hard substance, of a white or pale rose color, composing the skeleton or firmer part of the body. There are 246 bones in the human body. They give shape and firmness

THE ULNA.

THE HUMERUS.

THE SCAPULA.

to the body, protect the organs from injury, and afford a solid place for the attachment of muscles. All bones are curiously fashioned, and beautifully adapted to their various purposes. Where the object is to protect, the bone is strong and thick, and offers the greatest resistance with the least material, or is so placed as to defend the organ. Those designed for support are thick and solid. Long bones are hollow, and contain marrow, which is composed chiefly of blood-vessels and fat. The other bones are spongy and lattice-like inside, and hard on the outside. Bones are full of fine tubes through which the blood passes. The bones of the various animals vary in their texture, and are chiefly composed of phosphate and carbonate of lime and gelatine. Bones are covered with a tough membrane, except at the joints, where they are covered with cartilage. When this cartilage is removed the bone dies. The bones of the trunk are the pelvis, spinal column (see *Backbone*), the ribs, the breast-bone, the shoulder-blade, and the collar-bone. The bones of the arms are the humerus, the ulna, and the radius. The wrist has eight bones and the palm of the hand five. The bones of the legs are the femur, patella, tibia, and fibula. The ankle has seven and the body of the foot five bones. The skull is composed of a number of bones, which surround and protect the brain (*q.v.*).

Bo′rax. A compound of boron with sodium and oxygen, is obtained chiefly from Tuscany, and is found also in Tibet, China, Nevada, and California. It is used in soldering gold and other metals, and in the arts as a flux. Dyers use it to give a gloss to silks. It is employed also in medicine, and as a cosmetic. It is valuable as an insecticide, being fatal to roaches, and is much used in preserving meat, fish, butter, and milk.

Bore. [Icel.] A tidal flood which rushes into certain rivers of peculiar configuration, and is dangerous to shipping, as at the mouth of the Amazon, the Hoogly, and the Tsien-tang; also the flow of the tide in the Bay of Fundy and in Hang-chow Bay.

Boul′der. [Dan. *buldre.*] A mass of rock chiefly rounded, that has been transported by the action of ice and other natural agencies from its native bed. *Boulder clay* is the unstratified clay deposit of the glacial or drift period, and often contains large numbers of boulders. (See *Glacier.*)

Bow. [AS.] Anything bent in the shape of a curve, as a rainbow. A weapon made of wood or elastic material, with a cord connecting the two ends, by means of which an arrow is propelled.

Box. [AS.] A tree or shrub which grows in various parts of the world. The common box has two varieties. The dwarf box is used as an edging for gardens. The wood of the tree kinds is hard and smooth. It is extensively used by turners, engravers, and mathematical-instrument makers. Also a wooden case or receptacle.

Brace. [Fr.] A cord, ligament, or rope for holding anything tightly. Any piece of material used to transmit or change the direction of a weight or pressure. In the plural, straps to sustain trousers.

Brad′awl. [AS.] A straight awl with chisel edge, used to make holes for brads, or thin nails with a slight projection at the top instead of a head.

Brain. [AS.] The brain is the principal nerve centre, and occupies the whole cavity of the head. It is carefully enclosed by membranes, its upper part being called the cerebrum, and its lower part the cerebellum. The interior mass of the brain is composed of white matter, but the entire surface has a thin gray covering. The surface of the cerebrum is made up of irregular rounded ridges or convolutions. The greater the number and depth of the convolutions, the greater the amount of brain surface, and the greater the amount of gray matter which covers the surface. It is supposed that the gray matter increases with study or thought. A deep indentation extending from front to back divides the brain into parts, so that in reality the brain is double, corresponding to the pairs of the external portions of the body. The two halves are connected by a central mass of fibres. From the nervous mass within the skull twelve pairs of cranial nerves extend to different parts of the head and face. From the brain the spinal cord extends downward through the spinal column to the lower extremity of the body. In every action which comes from thought, the mind, through the brain, with its outgoing nerves, directs the first steps, and the brain is regarded as the organ of intellect and the seat of the soul.

Brake. [AS.] A mechanism for retarding or stopping motion through friction by the pressure or rubbing against wheels, or of clogs or ratchets against a rail, or of a pivoted lever against a wheel or drum in a machine. An air-brake operates by compressed air contained in an iron box on the engine connecting with the wheels of railroad cars.

Bran′dy. [Ger. *branntwein.*] A strong alcoholic liquor, distilled chiefly in France from wine. When wine is heated in a close vessel, the alcohol arises out of it as vapor. If the vapor be made to pass through a tube surrounded by cold water, the alcohol will be condensed to a liquid, which is brandy.

Brass. [AS.] An alloy of two parts of copper and one of zinc. Prince Rupert's metal, used in jewelry, has from 75 to 80 per cent. of copper. The alloy used in Dutch metal has 85 per cent. of copper. It is much used for machinery, telescopes, buttons, screws, etc.

Brazil-nut. The fruit of a large tree, found on the Orinoco River, South America. The nuts, which are known commonly as Cream Nuts, are three-sided, with hard shells, and white meat which is very good when fresh, but soon spoils from its abundance of oil. The nuts are packed in a smooth round case, half as large as a man's head, twenty or thirty of them in one case. They fall when ripe, rendering it dangerous to pass under the tree at that time. The monkeys are very fond of them, fighting for the nuts and throwing down the cases to break them.

Brazil-wood. A red dye-wood, brought from Brazil, and used in dyeing silks, the dye being got from the wood by boiling. Brazil got its name from this wood, which the Portuguese called *braza*, or glowing embers, from its red color.

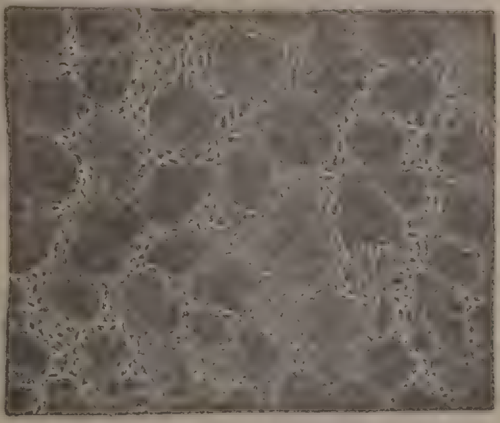
Bread. [AS.] An important article of food made from the flour of wheat or other grains. In the process of bread-making from 50 to 60 per cent. of water is added to the flour, in which yeast or other leavening matter is mixed. The yeast causes the dough to ferment, in which process the starch of the flour gives off carbonic acid gas. This forces the dough to swell, and fills it with a great number of air cavities, making it what is called light. The dough is then divided into loaves, and again left to stand, and again it swells. The loaves are then put into the oven, when the moisture evaporates and they swell, while a yellow crust begins to form on the surface. They are baked in the oven till the bottom crust is hard. The acid is driven out of the dough by the heat of the oven. Aerated bread was invented by Dr. Dauglish of Malvern. It has no leaven, but has carbonic acid gas forced into the dough by machinery. The mixture and kneading are also done by machinery. (See *Biscuit.*)

BREAD-FRUIT.

Bread-fruit Tree. A native of the South Sea Islands which bears a large, nearly round fruit, the size of a child's head. The pulp, when not quite ripe, is white and mealy, and is baked for food. It has little taste, but is very nutritious. The tree has been introduced into the West Indies and South America.

Break′water. A bank of stones or a structure of timber, built to break the violence of the sea before its entrance into a roadstead or harbor. A great quantity of large stones are usually sunk, and the bank which they form is built upon with large blocks of artificial stone. In some localities breakwaters of immense size and extent have been built.

Breath′ing. The act of respiration. The organs concerned in breathing are the nostrils, the wind-pipe and the lungs. The wind-pipe is a stout tube, divided below into two tubes, one of which goes to the right and the other to the left lung. When the ribs are elevated and the diaphragm is depressed, there is a tendency to produce a vacuum between the lungs and the wall-chest. The air forces its way into the air-passages of the lungs, and expands the lung tissue so that it fills the enlarged space within the chest. This is inspiration. When the ribs and diaphragm return to their passive condition, the pressure of the air ceases, and the elastic tissue contracts, forcing the air out. This is called expiration, and the whole act respiration. At every inspiration we draw into the lungs rather more than half a pint of cool, fresh air. At every expiration we send out the same quantity of hot, foul air. Air that has been breathed once is found to have lost about one-twentieth of its oxygen, and to have gained as much carbonic acid gas. Such air is not fit to be breathed again. While we are in the open air there is little fear of our being compelled to breathe the same air twice; but in



AIR-CELLS AND CAPILLARIES OF A HUMAN LUNG (MAGNIFIED).

rooms it is necessary to see that there are openings for the impure air to pass out, and other openings to allow fresh air to get in. If we reckon that we breathe fifteen times per minute, it can be readily calculated that an ordinary adult takes into his body from the air, by means of his lungs, 1½ lbs. of oxygen daily, and gives to the air a rather greater amount of carbonic acid gas. The frog has no ribs, but simply closes its lips and swallows the air which is in its mouth. Turtles swallow the air in the same way as frogs. Fishes get all the air they need from the water, which enters freely at the mouth and passes over the gills, and escapes at the gill slit—the oxygen from the water being absorbed by the blood of the gills. A fish out of water dies for want of oxygen, which it can take from water but cannot take from air, and so it is suffocated by air. Lobsters breathe only by gills, which are situated in a cavity under the body and attached to the legs, the action of the legs and of a spoon-shaped appendage causing a current of water to pass over the gills, which absorb the needed oxygen. Insects breathe by air-tubes that pass through every part of their body, and open on the surface of the body in small holes, which exclude water or dust, but admit air. (See *Lungs*.)

Brick. [Fr.] A mass of clay which is converted into building material by burning. The clay is dug up, exposed to the air and frost, and kneaded or mixed with water until it is a thick paste, and then moulded into bricks, which are called green or raw bricks. A brick-making machine will turn out from twenty to thirty thousand green bricks a day. These are burned in large ovens or kilns. The color of bricks depends on the proportion of iron they contain; red bricks have much iron, and cream bricks have little iron in them. Terra-cotta is a very fine clay of a delicate red color, made into bricks, urns, and statues. Bricks are used for buildings of all kinds, and are cemented by mortar made of sand and lime.

Bridge. [AS.] A roadway over a stream, valley, or low ground. *Viaduct* is applied to bridges over which a road or railway passes; and *aqueduct* is applied to those for carrying a canal or water. They are made of wood, stone, iron, or steel. Bridges are built in various ways. In shallow water they are supported from the bottom, or stone piers are built, and arches thrown from pier to pier. Suspension bridges are held up by strong strands of wire stretched from shore to shore. A common way of building bridges now is by truss or girder work, the bridge being sustained by iron girders firmly bolted together. There are many remarkable bridges in existence, some of them of great length and width and able to support immense weights.

Britan′nia Met′al. [From L. *Britannia*, Great Britain.] An alloy of tin, antimony, and copper. It varies in composition, but in general it contains from 80 to 90 per cent. of tin, with varying proportions of the other two metals. It is used for the manufacture of numerous articles for the table, also as a basis for electro-plating.

Bronze. [Fr.] An alloy of copper and tin, with a small quantity of zinc added. Bronze is used for statues, ornaments, bells, cannon, coin, etc. Turkish gongs and cymbals are made of a bell-metal plunged while hot into cold water. Hard bronze is obtained from 7 of copper to 1 of tin; while soft bronze, which bears rolling and drawing, contains 16 of copper to 1 of tin. Bronze for bells generally contains a little zinc and lead. Copper with 10 per cent. of aluminium yields a handsome golden yellow alloy, known as *aluminium bronze*, and much in use for various purposes.

Broom. [AS.] A low shrub with long, straight, green angular branches, minute leaves, and yellow flowers. The twigs, when tied together, are suitable for making brooms to sweep with.

Brussels-sprouts. A plant of the Cabbage family, which produces in the axils of the upright stems numerous small green heads or *sprouts*, each a cabbage in miniature.

Buck′wheat. [*Buck*, a beech tree; and *wheat*.] A plant of a family which includes knot-weed, called also Saracen wheat, with a triangular seed shaped like beech-nuts; when ground it is used in America for griddle cakes, in France for bread or as gruel. In England it is sown as food for pheasants, to decoy them from their covers. Its flowers yield excellent honey, of which bees are very fond, and it is often planted in the United States for this purpose.

Bud. [AS.] The rudiment of a branch, a leaf, or a flower. In biennial and perennial plants buds are formed towards the close of the growing season in the axils of the leaves. Terminal buds are those at the end of branches, and lateral buds are those at the sides. Buds are usually protected from the frost during winter by a covering of scales. The buds of plants growing in tropical countries have no special covering.

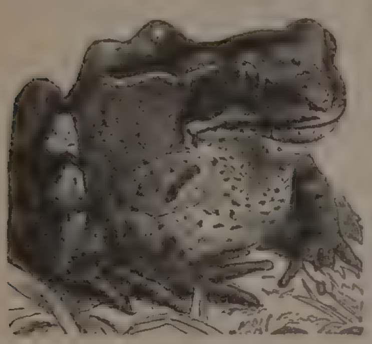
Buf′falo. [Span.] A ruminant animal of the Ox family, found in Southern Asia and Europe and in South Africa. The buffalo of Asia is a native of the East Indies, but has been introduced into other countries as far west as Italy. This animal is fond of water, and during the heat of the day lies in water sunk up to its nostrils. It covers itself with a coating of mud, as a protection against insects. It has long been domesticated and used as a beast of burden, and is the farming animal in the Phillipine Islands. The Cape buffalo inhabits South Africa, and is regarded by hunters as very fierce. Its horns are very broad at the base. Buffalo-horn is used for combs, drinking cups, and knife and fork-handles. The American bison is generally called buffalo. (See *Bison.*)

Bug. [Celt.] A general name applied to various insects, as squash-bug; but specially also the bed-bug. Also, loosely, any beetle, such as lady-bug, potato-bug, etc.

Bu′gle. [Fr.] A copper musical instrument for calling hounds or for summoning soldiers, first made from the horn of a wild ox. In bands the bugle is now superseded by the cornet.

Bull′finch. A European cage bird allied to the grossbeak, with the breast and neck red, It may be easily taught to whistle correctly musical airs.

Bull′frog. The largest of the frogs, it being generally 6 to 8 inches long, and 4 inches broad. It is very common in the United States, especially in the South, and derives its name from its loud call, which resembles the lowing of a bull.



THE COMMON FROG

Bun′ion. [Fr.] A swelling usually on the first joint of the great toe, caused by continued pressure of tight boots.

Bun′sen Burn′er. This burner consists of an ordinary gas-jet over which is placed a metal tube about 5 inches long, perforated with holes at the bottom. When the gas is lighted, air is drawn through the holes, and mixes with the gas before ignition. From this air a plentiful supply of oxygen is obtained to allow complete combustion to proceed at once throughout the whole flame, and thus a smokeless, non-luminous flame of great heating power is obtained. The burner is used for various purposes, such as fire-lighting, cooking, ironing, heating, and soldering.

Buoy. [Du. *boie*, a chain.] A floating mark or beacon to point out a shoal or danger, usually chained to its place. Life buoy, a float intended to keep from sinking. Bell-buoy, a buoy with bells rung by the waves.

Bur′dock. A rough wild plant, very common in Europe and the United States. It is about a yard high, has large coarse leaves and purplish flowers, and bears prickly seed burs, which catch on clothing, the wool of sheep, etc., and are thus scattered. The leaves and their juice are of use in healing burns or the itching effect of poison ivy.

Bush′el. [Fr.] A measure of capacity of 4 pecks or 8 gallons or 32 quarts. The English imperial bushel contains 80 lbs. of water at 62° F. The United States bushel contains 77.6274 lbs. of water at 39.8° F.

Bust′ard. A bird, native to Europe and Asia, where it inhabits dry open plains. It has large wings, but rises in the air only at times. When on the wing, its flight is strong and sustained. It generally runs along the ground, and feeds on vegetable matter, worms, and insects. The Great Bustard has a long neck and longer legs, measures about 2 feet 6 inches in length, and weighs about 20 lbs. The Little Bustard is about half this size.

But′ter, [AS.] A fat contained in milk, and obtained from the cream by churning. The cream is beaten about in the churn until the skin of curd which exists around every little ball or globule of fat is broken; the particles of fat then stick together and form butter. The butter is then well washed in fresh water, to remove the small pieces of curd. A little salt is mixed with fresh butter; but if the butter is to be kept for a long time, much more salt must be used. Like all fats, butter is almost entirely a heat-giving and force-producing food.

But′tercup. [AS.] A kind of crowfoot with bright-yellow flower. It is the cuckoo-bud of Shakespeare. (See *Flower.*)

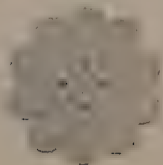
But′terfly. The most beautiful of insects, having wings covered with colored dust, which is really fine, shiny, iridescent scales. The butterfly is therefore called a scale-winged insect. Young caterpillars are hatched from the eggs of the butterfly. In some cases these eggs are beautiful, shaped like vases and caskets. They are fastened to leaves, and the mother, during her brief life, seeks to deposit them on that plant which, after the caterpillars are hatched, will afford the proper food. The eggs of butterflies lie dormant during the winter, because the cold of winter would be fatal to the young insects. and the leafless trees would afford the caterpillars no food; but the warmth of the spring soon develops the living embryo. The caterpillar is composed of thirteen rings joined together, and has six jointed legs on three of the rings behind its head, like the six legs of its mother. These remain with it through life, while the four pairs of legs on the rear part of its body disappear. The caterpillar crawls over the plant upon which it was born, devouring the green leaves. During this stage it is called a larva. After a time it ceases to eat, and becomes a pupa or chrysalis. Under its chin is a little spinner, from which issues a silken thread, with which it suspends itself, head downwards. Others hang from the tail. The chrysalis remains as if dead, but is really feeding on the fat formed in the body of the larva; and in due time the *imago*, the perfect butterfly, comes forth, dries its wings, and flies away full grown. Butterflies fly in the daytime, and when they rest their wings are raised over their back. The antennæ stretch out nearly straight, and end in knobs. The under side of the wings often resembles in color the flower upon which the butterfly feeds. Conspicuous are the large round eyes, which under the microscope are found covered with numerous flat surfaces. These are called compound eyes, for they consist of a great number of eyes crowded into a mass. There are about five thousand kinds of butterflies. They are great rovers, and having no homes they flit about among the most brilliant but shallow blossoms, perfecting their seeds.

Buz′zard, [Fr.] A bird of the Falcon family. There are various kinds of this bird of prey—the common buzzard, the rough-legged buzzard, the honey buzzard, the moor buzzard, the bald buzzard or osprey, the carrion buzzard. and others.

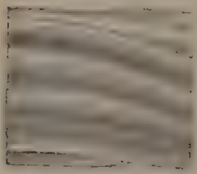
C

Cab′bage. [O.E., or L. *caput*.] An esculent vegetable with a foot-stalk, short, strong, and fleshy, which runs as a great rib to the point of the blade, while smaller ribs run from it to the edges. The common cabbage has a compact *head* of leaves, hence its name. It is one of the most nutritious of ordinary vegetables. Red cabbage is used as a pickle. In the Channel Islands, a tree-cabbage four feet high is grown to feed cattle.

Cab′inet. [Fr.] A safe place for jewels or paper; usually a set of drawers or a cupboard closed with doors. *Cabinet.* A private room in which consultations are held. Monarchs formerly consulted with their councillors in cabinets, hence the name became applied to the board of councillors. In the United States it is applied to the heads of the government departments who act as adviser of the President.



Ca′ble. [Fr.] A strong chain or rope for fastenings ships or other purposes. Telegraph cable is a rope of gutta-percha, yarn, and iron wire, in the centre of which are copper conducting wires to be laid underground or under the sea. The largest chain cable, with links 2⅞ inches thick, was made especially for the steamship *Great Eastern*.



A CABLE.

Cac′tus. [L.] A kind of plant like the prickly pear, found in tropical America, usually with leafless stems and branches, and sometimes clustered thorns. (See *Cochineal*.)

Cad′dy, [E. Ind.; from Malay, *kati*, a weight of 1½ lbs.] A small box for holding tea.

Caffe′in. [Fr.] A white, bitter, crystallizable substance obtained from coffee.

Cais′son. [Fr.] An apparatus used in laying the foundation of bridges under water. One form is an inverted water-tight hollow box with iron-bound edges, in the bottom of which some masonry has been constructed. The weight of the masonry forces the caisson into the sand and mud at the bottom, and air, under pressure, is then forced in, driving out the water and allowing the workmen to enter through the air-tight locks.

Cake. [Scand., or L. *coquere*, to cook.] A mass of dough, made palatable by the addition of sugar, eggs, fruit, and other materials, and baked in the oven; or made into a batter and baked on a griddle. It differs in these respects from bread. Also the compressed seeds of flax, rape, and cotton. These contain much oil, which is extracted by strong pressure, leaving a compact cake of about half an inch in thickness. Oil cake is used as food for animals, half-a-pound a day being sufficient for a sheep and five pounds for a bullock. It is used in addition to grass, hay, or other food.

Cal′abash. [Span.] A tree found in tropical America, the gourd-like fruit of which has a soft pulp, and its shell is made into drinking-cups and bottles.

Cal′amus. [L. *Acorus calamus*.] The Sweet-Flag, a plant found in ditches and by the side of ponds in Asia, Europe, and North America. The root-stock yields an aromatic stimulant and tonic, much used as a medicine in the East. It is also made into confections and used in liquors in Germany. Some persons chew it to clear the voice and sweeten the breath.

Cal′cium. One of the metallic elements, whose oxide is the abundant and very useful lime. It occurs abundantly as limestone, and in its crystallized form as marble. Calcium carbonate is so abundant in nature that it is found in most natural waters, in which it is dissolved and carried to the sea. Sulphate of lime is a common constituent in what is known as *hard* water, and is found in sea water. In its solid state it is known as Gypsum, or Plaster of Paris.

Cal′culating Machine. An instrument in which, by the movement of keys, acting upon an intricate mechanism, arithmetical calculations may be made. The Babbage machine was capable of performing remarkable operations, but was of no practical use. There are simpler instruments now in use which add, subtract, multiply, and divide with wonderful speed and accuracy.

Calf. [AS.] The young of the cow and of some animals; also leather for bookbinding made from calf-skin. The flesh of calves is called veal. Calf-foot jelly is the gelatine of the feet of the calf, extracted by boiling and flavored with sugar or essences.

Cal′ico. [E. Ind.] Fine white cotton cloth, with special names, as super calicoes, shirting calicoes, unbleached calicoes. Also cotton [illegible] cloth with a figured pattern.

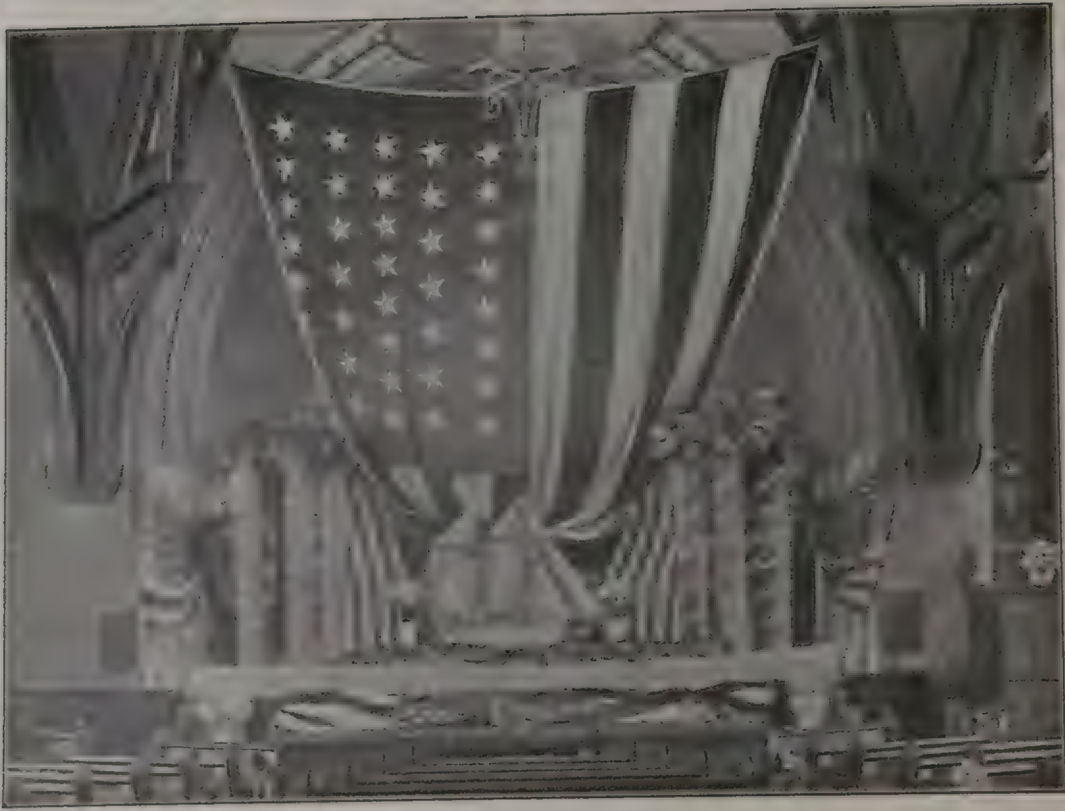
Cal′ipers. A kind of compasses with curved legs for measuring the diameter of round bodies.

SPECIAL DECORATIONS

The table is prepared for a special occasion and profusely decorated with flags, potted plants and vines. This answers for all patriotic occasions. At the right is a beautiful window box and hanging basket.

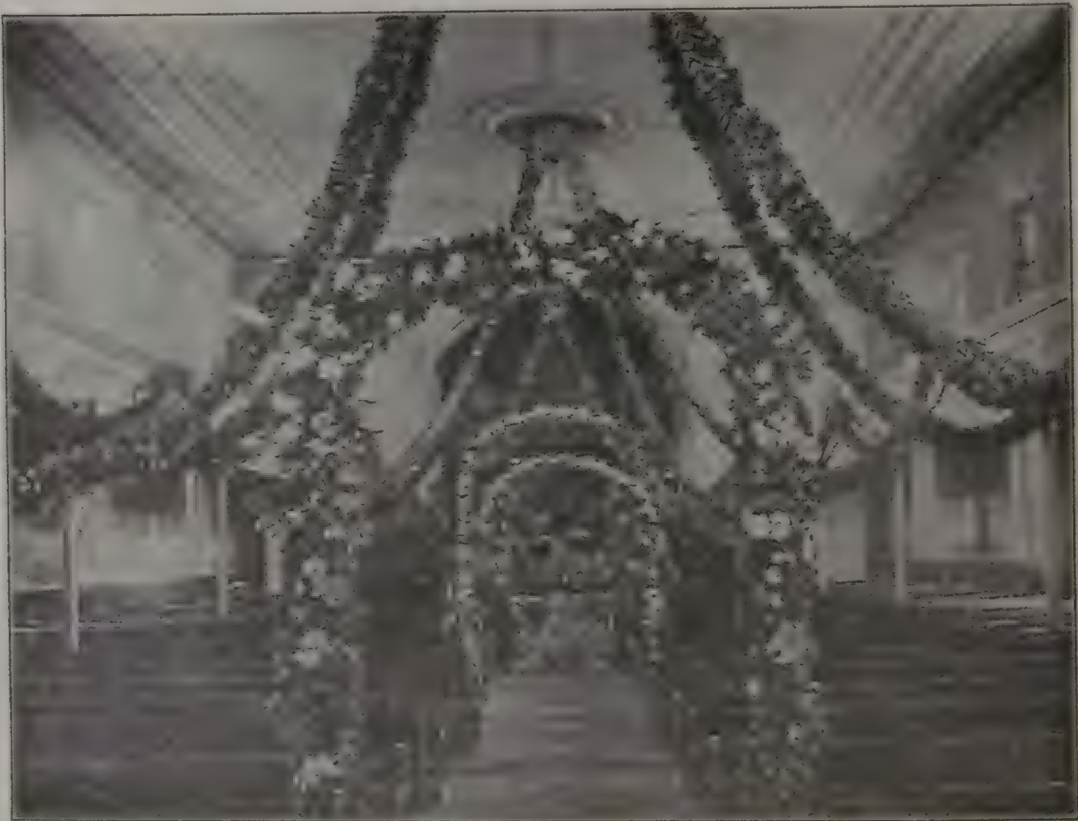
TABLE DECORATIONS

A happy suggestion for the arrangement and decoration of a dinner-table for a special occasion, such as a wedding dinner. The contrast of light draperies on the walls and the green of the plants is very effective.



PATRIOTIC DECORATIONS

Decorations used to instil patriotism are the most commendable of the many public occasions.—Children's Days, Commencements and national holidays are the most popular. Flags and bunting, banks of daisies, a "Ship of State" and floral columns are seen in this illustration.



DECORATIONS FOR A WEDDING

This is an interesting view of elaborate designs, in arches and festoons. The green and white in the arches and in the pulpit decorations are easily procured and arranged

Cal′omel. [Gk.] A compound of chlorine and mercury, which is found native as horn quicksilver in Bavaria, Bohemia, and Spain. It is of great value in medicine, being one of the mildest and most frequently used of all the preparations of mercury. It is used for the liver, as an ointment, and in producing salivation.

Calor′ic Engine. A form of air engine, invented by John Ericsson, which is in considerable use for light machinery. In its working parts it resembles the steam engine, but is operated by the expansive power of hot air instead of steam.

Cal′yx. [Gk.] The outer covering of a flower. It is usually green and leafy, but in such flowers as the anemone is delicate and resembles the petals. Each leaf of the calyx is a sepal. (See *Flower*.)

Cam. [Dan.] A turning or sliding piece of machinery, which, by the side of its face or a groove on its surface, changes the motion of another piece against which it acts. Cams are used in the pin-machine, the sewing-machine, and others where varied motion is required.

Cam′bric. A kind of fine thin white linen, first made at Cambray in Flanders. Cambric muslin is thin white cotton.

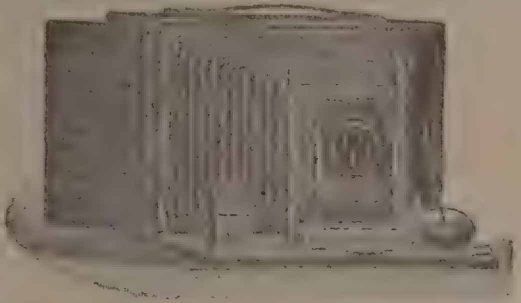
Cam′el. [L. *camelus.*] A most useful ruminating animal, which for centuries has been used as a beast of burden or ship of the desert on the sandy plains of Africa and Arabia. It is well adapted by nature for life on the desert. It can go for many days without water, being provided with a remarkable arrangement of cells in its stomach or paunch which it fills with water, and keeps as a store for future use. Its two long toes rest on a broad, horny cushion, which enables it to walk without sinking in the sand, and its nostrils can be closed at will to shut out the fine dust of the sand-storms. The African or Arabian camel has one hump, and is called the dromedary. The Bactrian camel of Central Asia has two humps. The hump is not a part of the skeleton, but is a mass of fat which slowly lessens when the animal is on long journeys and food is scarce, it being consumed as nutriment. The camel is about six feet in height, and not very rapid in speed. It is very useful to the Arab, conveying himself and his belongings on a journey, and yielding him flesh and milk for food, hair for weaving into a covering, and hides for sandals and saddles. Camel hair is used for painters' brushes.

Camel′lia. [Probably named after Kamel, a Jesuit, who first brought the plant from the East.] An Asiatic shrub with shining green leaves and showy flowers. In China oil is pressed from its seeds.

Camel′opard. [Gk. *kamelos*, camel; and *pardos*, a leopard.] An old name of the giraffe, arising from the idea that it was an offspring of the camel and the leopard.

Cam′eo. [Ital.] A precious stone, as an onyx or sardonyx, having a figure carved in relief on the surface.

Cam′era Obscu′ra. [L.] An optical instrument. In its simplest form it consists of a rectangular box fitted at one end with a lens and at the other end with a plane mirror, inclined at an angle of 45° to the horizon. When the lens is directed to any object, the rays of light, after passing through the lens, are reflected from the mirror, and form an image on a plate of glass at the top of the box, where they may be observed and sketched. Instead of the box it is usual to have a kind of tent surrounded with curtains to keep out the light. There are various forms of the *camera* now in use for taking photographic negatives, the photographic camera being an adaptation of the camera obscura, which is fitted at the back for the introduction of a sensitized plate or film, so as to receive the image of an object or scene in front of the lens.



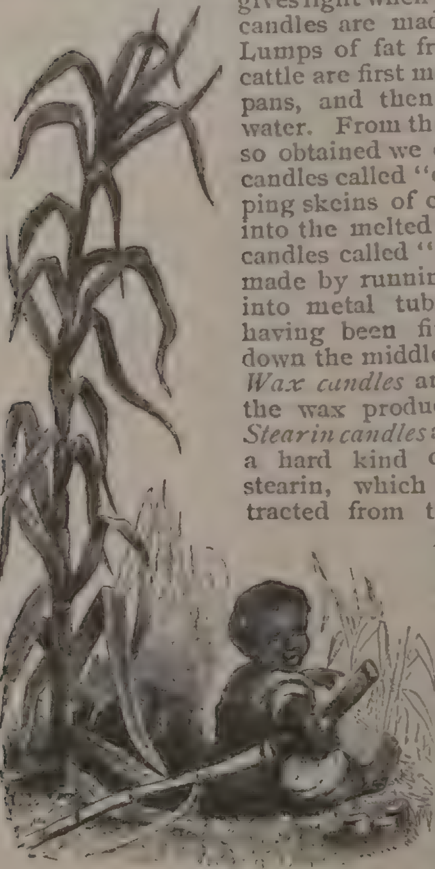
Cam′omile. [Gk. *chamai*, on the ground; and *melon*, an apple.] A bitter herb used as a medicine. Its flowers have a strong and fragrant smell, with an aromatic taste. Its volatile oil is used as a carminative.

Cam′phor. A white resinous substance existing in many plants, but mainly obtained from the camphor laurel, grown in China, Formosa, and Japan. The Borneo or Sumatra camphor, highly esteemed in China, is obtained from a lime tree in Sumatra, Borneo, and the Malay Peninsula. Camphor has an aromatic odor and a strong, unpleasant taste, and is soluble in alcohol and oil. Spirits of camphor is camphor dissolved in spirit. When this solution is poured into water, the camphor reappears in white flakes. Camphor is used as a medicine, and enters largely into varnishes used by painters. It is also used to kill moths and other insects among furs or woolen cloths. For a further important use of it see *Celluoid*.

Canal′. [L. *canalis*, a pipe.] A waterway made for boats or ships or for irrigation. The barrier which confines the water is called the weir or guard-lock, and the enclosure with gates at each end to raise or lower boats as they pass from one level to another is called the lift-lock. Most famous among canals is the Suez Canal, which was opened November 17, 1869. It is 87 miles long—66 miles actual canal and 21 miles lake—connecting the Mediterranean and the Red Seas. An effort to connect the Atlantic and the Pacific Oceans by a canal across the Isthmus of Panama has been made, but as yet without success, and it is proposed to make a similar canal across Nicaragua by the United States government. There are thousands of miles of canals in Europe and America.

Cana′ry. A cage bird about the size of a sparrow, which is found wild in the Madeira and the Canary Islands. Great quantities of tame birds are raised in Germany. In its wild state it is generally of a dusky gray color; but tame birds are of very many different colors, those with white or yellow feathers being most valued. The tame bird is a sweet singer, some having the skylark, others the woodlark, and others the nightingale note. It is the favorite among cage birds.

Can′dle. [L. *candela*, a (white) light made of wax or tallow; from *candere*, to be white.] A twist of threads surrounded by tallow or wax which gives light when lit. Common candles are made of *tallow.* Lumps of fat from sheep or cattle are first melted in large pans, and then boiled with water. From the fat or tallow so obtained we can make the candles called "dips," by dipping skeins of cotton (wicks) into the melted tallow. The candles called "moulds" are made by running the tallow into metal tubes, the wick having been first stretched down the middle of the tube. *Wax candles* are made from the wax produced by bees. *Stearin candles* are made from a hard kind of fat called stearin, which can be extracted from tallow. *Composite candles* consist of a mixture of tallow and stearin. *Paraffin candles* are made of solid paraffin, which, like paraffin oil, is prepared from a mineral substance that oozes out of or can be obtained by heating certain rocks called bituminous shales. (See *Smelt.*)



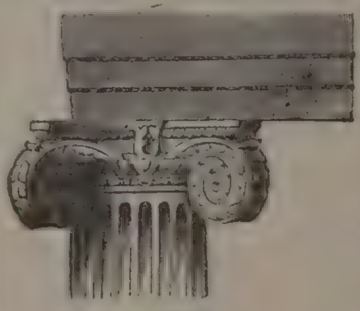
SUGAR CANE.

Cane Sugar. The variety of sugar obtained from the sugar-cane and the sugar-beet, as distinguished from *grape-sugar*, which is obtained from maize and some other plants. (See *Sugar.*)

Can′ister. [L. *canistrum.*] A basket of reeds, or a small box for holding tea or coffee.—*Canister shot*, or case shot, a kind of shot with a number of lead or iron balls enclosed in a case which bursts when fired.

Can′nel Coal. A hard, jet-black variety of coal which burns with a bright white flame. The gas yielded by this coal has nearly three times the illuminating power of that obtained from common coal. It is hard enough to be cut and polished like jet, and is sometimes made into trinkets. In Scotland it is known as parrot coal.

Can′non. [Fr. *canon*; from L. *canna*, reed, pipe, tube.] A piece of ordnance or artillery. The large cannon now in use consists of a forged steel tube strengthened with massive steel rings shrunk upon it. Howitzers and mortars are sometimes called cannon. Cannon are distinguished by the weight of the ball, or the diameter of their bore. Some of the great rifled guns now in use can send a heavy ball a distance of 10 or 12 miles.



CAPITAL.

Canoe′. [Span. *canoa.*] A boat made of the trunk of a tree hollowed, or of bark or skins. It is propelled by a paddle or sails, and has no rudder.

Can′teen. [F. *cantine*, bottle case.] A refreshment house in a fort or barracks for the use of soldiers, where they can purchase food and other necessaries, and intoxicating liquors under certain restrictions. A vessel, usually of tin, used by soldiers, in carrying water or other liquids.

Can′vas. [Fr. from Gk. *kannabis*, hemp.] A coarse cloth for sieves, sails, and sacks, made from hemp, flax, or cotton; the cloth on which a picture is painted.

Caout′chouc. [Ind. pronounced *koo′chook.*] The elastic gum of several trees in South America, Africa, and Asia. It is impervious to liquids and gases, and is much used in the arts and manufactures. (See *India-rubber.*)

Capercail′zie. [Celt.] A kind of large grouse with a fine flavor found in Scotland and in Northern Europe, especially Norway and Sweden, and known under the name "cock of the woods."

Cap′illary. [L. *capillus*, a hair.] A tube with a hair-like bore; a minute blood-vessel.

Cap′illary Force. The force by which water ascends in wood, sponge, blotting-paper, and other porous bodies. By the same action the flame of a lamp is fed with oil. The wick is a bundle of threads whose surfaces are nearly in contact, and the oil rises between them in the same way as if they were narrow tubes. Water is supposed to rise from reservoirs and springs below the surface of the ground to the roots of plants in the same way as it rises in fine tubes.

Capillary action seems to be due to an attraction between water and the surfaces of solid substances.

Cap′ital. [Fr.] The head of a column, and consisting of abacus, bell, and necking. The Greeks used three orders—Doric, Ionic, and Corinthian. The Romans added Tuscan and Composite. Other orders in use are Byzantine, Moorish, and Gothic. Also the seat of government of a state or a nation. *Capital letters*, heading letters, used at the beginning of sentences, etc.

Cap′itol. Originally the great national temple of Rome. A modern Capitol now stands on its site. The name has been applied to the building in which the United States Congress holds its sessions; also to the legislative halls of the States.

Cap′stan. [Fr.] A vertical drum revolving on an upright spindle with a drum-head, in which are sockets for bars or levers. It is used on board ship to raise weights by means of a rope, and is worked either by steam power or by men walking round pushing on levers in the sockets.

Cap′sule. [L. *capsa*, a chest.] A seed-vessel of a plant containing many parts or carpels, as the flax, the poppy, and the lily; a metallic seal or cover for closing a bottle; also in medicine a gelatinous envelope in which bitter doses are enclosed.

Car. [Fr.] A frame on wheels for carrying persons or loads. In the United States the word is applied to vehicles used on railroads or for street travel. Railroad cars are called *carriages* in England, except Pullman cars, train cars, etc., introduced from America.

Car′at. [Fr.] A weight of 3⅙ grains Troy, divided into four parts or carat grains, for weighing gold, diamonds, or precious stones; the twenty-fourth part of any quantity of pure gold. Goldsmiths' standard is 22 carats, which consists of 22 parts of gold, 1 of copper, and 1 of silver.

Car′avan. [Per. *karwan*.] A company of merchants, pilgrims, or travelers, joined together for mutual safety and protection, in Asia and Northern Africa, with camels as the usual means of conveyance. A large covered carriage for conveying passengers or wild beasts or furniture. Shortened into *van*.

Car′away. [Bot. name *Carum carvi*.] The seed of a plant like a carrot, of the Parsley order, grown in Holland; used in confectionery and as a carminative.

Carbide of Calcium. A product of the electric furnace, consisting in a compound of calcium and carbon. It is of interest from the fact that when met it yields in abundance acetylene gas, remarkable for its illuminating powers.

Carbol′ic Acid. An organic compound derived from coal tar. When pure it is a white crystalline substance, possessing a burning taste and the odor of creosote. In the crude form it is largely used as a disinfectant. It is also applied externally to wounds and abscesses after they have been opened. Taken internally, it acts as an irritant poison, but in small quantities it is used as a medicine. Drains and sewers are sometimes flushed with solution of carbolic acid in order to remove infectious matter.

Car′bon. A non-metallic element known only in the solid form and very widely distributed. It enters into the composition of all organic structures, whether animal or vegetable. It is found in all the animal tissues, and, with oxygen, hydrogen, nitrogen, and sulphur, makes up the whole plant—wood, leaves, and flowers. All vegetable products—such as sugar, starch, gum-arabic, alcohol, oils—consist largely of carbon combined with oxygen and hydrogen. Carbon is the chief constituent of coal; and coal, when heated so as to expel its gases, is turned into coke, which is also carbon. Carbon is also found under the form of what is often named blacklead, but which is properly called plumbago or graphite. This is the substance from which pencils are made. The diamond, though widely different in appearance from all the other forms, is pure carbon.

Carbon′ic Acid. One of the products of the combustion of carbon, also known as carbon dioxide. When coal or wood burns brightly in the fire, carbonic acid is produced, and it may be prepared artificially by acting on chalk or marble with hydrochloric acid. The air we breathe contains oxygen, which enters the blood, combines with the waste carbon of the tissues, and is breathed out again as carbonic acid. This substance is given out in large quantities from volcanoes, and from the ground in volcanic regions. It is also produced during the fermentation of wine and beer. It is one of the permanent gases of the atmosphere, in the proportion of about 4 volumes in 10,000. Plants derive it from the atmosphere and supply it to animals.

Carbonif′erous Sys′tem. In geology the system of Primary rocks overlying the Devonian. It takes its name from the extensive coal-beds which it contains. In the system there are two well-marked sub-divisions—the lower section consisting of carboniferous limestone, and the upper, of the coal-bearing division of the system known as the coal-measures. These comprise sandstones, dark shales, and seams of coal. The flora of the Carboniferous period consisted almost entirely of flowerless plants, such as ferns; and among the fauna, fossils of true air-breathing animals and various insects are found. The system is very largely developed in the United States. (See *Coal*.)

Carborun′dum. A compound of carbon and silicon, produced in the electric furnace. It was discovered in 1890 in an effort to make artificial diamonds, in which bright blue crystals hard enough to cut precious stones were formed. When powdered it is superior as an abrasive to emery and even to diamond dust. It is now largely produced at Niagara Falls, and widely used as a sharpening agent.

Car′buncle. [L. *carbunculus*, a small coal.] A precious stone of a fiery-red color, found in the East Indies—a ruby, sapphire, or garnet. A hard and painful swelling on the skin on the trunk or back of the neck, larger than a boil, and with no central core.

Card. [L. *carduus*, a thistle.] A comb with bent wire teeth set in leather to smooth and arrange the fibres of cotton, flax, wool.

Car′dinal Bird. An American song-bird or finch, with bright-red feathers and a high-pointed crest.

Ca′ret. [L. *caret*, to want.] A mark (^) on a line of print or writing to show that something wanting and interlined or on the margin ought to be inserted.

Car′mine. [Fr. *carmin*.] A rich red or crimson color with a purple shade, prepared from cochineal, and having acid properties.

Carp. [Dan.] A fresh-water fish, originally from Asia, but now in Europe, reared in artificial ponds, and latterly also introduced into America. The leather carp is almost wanting in scales, and the mirror carp has only a few large scales.

Car′pentry. [L. *carpentum*, a coach.] A work in wood for the construction of buildings. A carpenter frames and puts together roofs, partitions, and floors of buildings; a joiner makes the doors, shutters, stairs, mantle-pieces, and other parts requiring more neat joining.

Car′pet. [Fr. *carpette*.] A thick covering or the floor, usually of wool, but also of cotton, hemp, and straw, and made in breadths to be sewed together and nailed on the floor. Brussels carpet is made of worsted yarn on a foundation web of strong linen thread, the worsted being drawn up in loops to show the pattern. Kidderminster carpet is an ingrain carpeting chiefly made at Kidderminster, England. Tapestry somewhat resembles Brussels, the warp being printed at intervals before weaving, so as to produce the figure in the carpet. Turkish carpets and Persian carpets are made similarly with woolen threads on a linen warp, and are similar in color and in softness. Axminster carpets are like Turkish, but are made with worsted, and are very handsome. Moquette, Chenille, and Wilton are velvety carpets.

Car′riage. Motor. (See *Automobile*.)

Car′rier-pig′eon. A variety of domestic pigeon used to convey letters from a distant point to its home. It has been used in war.

Car′ronade. [From Carron in Scotland, where first made during the Peninsular War.] A short cannon without trunnions, but supported on its carriage by a bolt.

Car′rot. [Bot. name *Daucus carota*.] A biennial plant with a long tapering spindle-shaped root of a red color. It is used in soups and stews, and highly valued as a food for cattle.

Cart. [Celt.] A frame on two or more wheels for carrying loads. In excavating sand, gravel or earth, one-third cubic yard of material before it is loosened is a cart-load.

Car′tridge. [Fr. *cartouche*.] A case of paper or metal containing powder and sometimes shot for a gun. Ball cartridge contains a projectile, and blank cartridge is without one.

Ca′sein. [L. *caseus*, cheese.] An albuminous substance contained in milk, and forming the principal constituent of cheese. The casein in milk is not coagulated by boiling, like albumen; but *rennet*, or an acid, separates out the casein and butter as *curds*, leaving the milk, sugar, and salts as *whey*.

Cas′sia. [Semitic.] The pulp of the pods of a leguminous shrub in the East Indies; also the bark of Chinese cinnamon, imported as cassia and sold as cinnamon, from which oil of cinnamon is extracted.

Cast-I′ron. Iron that is cast into pigs or moulds. It contains more carbon than steel, is brittle in character, but is used for many purposes. (See *Iron*.)

Cas′tor Oil. A mild cathartic oil got from the castor-oil plant (*Ricinus communis*), and used as a medicine. It is colorless, but possesses a nauseous taste. In India it is obtained in such abundance as to be used for illuminating as well as for medicinal purposes. It is greatly made in France, Italy, and the Western States of America.

Cat. [L. *catus*.] A small domestic animal, of the same family as the lion, tiger, leopard, etc. The cat is a flesh-eater, and is fond of birds and mice. It has a fur coat, smooth and glossy and soft as silk; has padded feet, can run or walk noiselessly and is a good climber. The cat seeks its prey at night, having excellent powers of vision, while the long stiff hairs around its mouth are very sensitive, and aid it to find its way in the dark. There are several varieties of cats, as the Angora, Manx, Maltese, Persian, and tortoise-shell. The Persian has long, soft, silvery hair and bushy tail. The Manx cat has no tail. Wild cats feed on birds, rabbits, hares and poultry.

CATERPILLAR.

Cat′acombs. [Gk. *kata*, downward; *kymbe*, cavity.] Great excavations in the vicinity of ancient Rome, used for burial by the early Christians. They are cut in a soft volcanic material, and the total length of their galleries is at least 300 or 400 miles.

Cat′bird. An American bird allied to the Mocking-bird, and possessing a remarkable power of imitating the notes of other birds. Its spring song is mellow and sweet, but it has also a disagreeable note, somewhat like the mew of a cat. It is found in the eastern half of the United States.

Cat′erpillar. [Fr.] The larval state of a butterfly or moth. True caterpillars have three pairs of true legs and several pairs of fleshy legs armed with hooks. They usually feed on leaves, fruit, and vegetables. Some are called worms—as silkworm, canker-worm, etc. After a time they surround themselves with a sheath or case of leaves, silk, or other substance, pass into the chrysalis state, and finally emerge as the mature insect. (See *Butterfly.*)

Cat′fish. A common American fish, with naked skin and eight fleshy barbules on the head. It is from 7 to 9 inches long, and is a favorite food-fish. The Great Lake Catfish, found in Lakes Erie and Ontario, is from 2 to 4 feet long, and weighs from 6 to 30 pounds. There are also very large catfish in the Mississippi and other rivers of the West.

Cat′gut. A cord of great toughness made from the intestines of animals, especially of sheep, and used for musical instruments.

Cat′kin [O.E.] The flowers of willow, poplar, and some other trees. It consists of a slender axis with many flowers wanting in petals along its sides, and is called catkin from its resemblance to a cat's tail.

Cat′nip or **Cat′mint.** [L. *Mentha cataria.*] A plant common in the United States, of whose leaves cats are very fond. They have a sharp and bitter taste. A tea made from them is sometimes used as medicine.

Cats′eye. A very precious stone which, when cut in a certain way, presents different colors, like the opal. It is so named because the eye of the cat has a similar power.

Cattle. A term denoting all animals of the ox kind. [See *Cow.*]

Cau′liflower. [Fr.] A variety of cabbage with a cluster of flower stalks and buds. It is more delicate in taste than the ordinary cabbages, and much esteemed as food.

Caus′tic. [Fr. from Gk. *kaiein*, to burn.] A substance that burns the flesh. Caustic lime is slaked lime, also quicklime. Caustic potash and soda are the hydroxides. Caustic silver or lunar caustic is nitrate of silver.

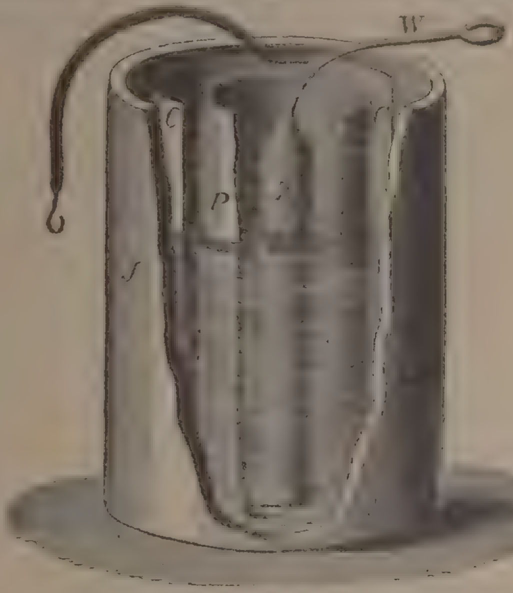
Cave or **Cav′ern.** [L. *cavus*, hollow.] A hollow place underground. Among the most interesting caves are the Mammoth Cave of Kentucky; Fingal's Cave, a basaltic cave in Staffa, Scotland; the Adelsburg caves, in Carniola; and the Luray cave, in Virginia. Many caves contain splendid stalactites and stalagmites. Mammoth Cave has been penetrated for 10 miles, and contains a river and many splendid apartments. The greatest caves occur in limestone strata. Primitive man seems to have dwelt in caves, and bones and implements left by him have been found there.

Ce′dar. [L.] An evergreen tree with spreading branches and hard red wood with a fragrant smell. The chief varieties are the cedar of Lebanon, the white cedar, the American red cedar, the Spanish cedar. Cedar has a pleasant smell, and is much used for making chests and cabinets. The red cedar of Florida is largely employed in making lead pencils.

Cel′andine. [Fr. from Gk. *chelidon*, a swallow.] A plant like a poppy, with yellow flowers, supposed to come and go with the swallows. It is used as a medicine in jaundice and for warts.

Cel′ery. [Fr.] A vegetable of the Parsley family of which the blanched leaf-stalks are used as a relish for food.

Cell. [L.] One of the smallest parts of a plant or animal. All cells have their origin in the primary cell from which the organism was developed. Also in electricity a jar or vessel, or a division of a vessel, for holding the fluid of a battery. Daniels' cell. *Z*, Zinc rod in porous pot *P*, containing dilute sulphuric acid; *C*, copper in outer vessel containing copper sulphate solution. Also a room in a prison, a sleeping room in a monastery, a small cavity or hollow place.



DANIEL'S CELL.

Cel′luloid. An ivory-like compound of camphor and collodion. It is made into knife handles, pianoforte keys, billiard balls, shirt collars and cuffs, and many other things, and used instead of glass for photographic dry plates.

Cel′lulose. A substance which is the basis of almost all vegetable fabrics. It has recently come into use as a lining for war ships to prevent the inflow of water through shot holes. It does this by swelling when wet. A preparation was first used for this purpose made from the fibrous husk of the cocoanut, but a better article is now in use obtained from the pith of the cornstalk.

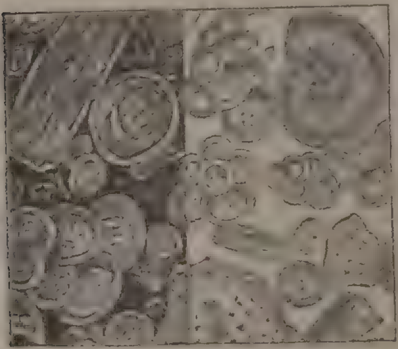
Cem′ent. The best-known cements are Portland and Roman cements, and are distinguished from mortar by hardening quickly, while mortar hardens slowly. Portland and Roman cements both *set* or harden under water; hence they are generally spoken of as *hydraulic* cements, although they are often used in superior masonry which is not intended to be covered by water. Portland cement is made of chalk or ground limestone mixed with clay or shale. Roman cement is made from a natural mixture of lime and clay. Of the natural cement stones found in the United States, the best are the Rosendale cements of New York. A cement made of carbonate of magnesia is superior in strength and hardness to all others. For ordinary cementing plaster of Paris is very useful, and there are many cements to mend broken glass, ivory, wood, etc.

Cen′tipede or **Cen′tiped.** [L. *centum*, a hundred; *pes*, foot.] An animal with one hundred feet or with many feet. They are also many-jointed. Large, flat-headed, venomous kinds live in tropical countries.

Centre of Gravity. The point in a body at which we may suppose the whole weight of the body to be collected; and therefore so long as this point is supported the body will rest indifferently in any position.

Chaf′finch. [O.E.] An English song bird, said to like chaff, and valued as a cage-bird. (See *Finch.*)

Chalk. [AS.; L. *calx*.] A form of soft limestone, widely spread in parts of Europe; not found in America. In southeast England it forms a bed nearly one thousand feet thick. If we pour a drop of vinegar on a lump of chalk, there is a bubbling up, or effervescence, which is due to carbonic acid gas escaping from the chalk. The chalk, in fact, is nearly pure carbonate of lime, which is a compound of the metal calcium with carbon and oxygen. All limestones can be detected in this way by pouring on them a few drops of some acid. Most limestones are composed of the shells or hard parts of the coral-building animals, but chalk is composed of the shells of minute swimming or floating animals, whose hard parts, after death, sank to the bottom and collected into thick layers. These were afterwards uplifted to the surface and became cliffs or beds of chalk. Chalk is used in connection with the *blackboard* in lecture-rooms and schools. Various preparations of it are made for pastel colors. It is also used as a manure.



Chame′leon. [L.] An animal of the Lizard tribe which has the power of changing its color at will. In a dark place it is white or grayish, but when light is admitted its color changes to red, green, or brown, in accordance with the color of its location. It lives in trees, and has a very extensible tongue, covered with a sticky secretion, by which it can seize insects and draw them into its mouth.

Cham′ois.. [Fr.] An animal of the Antelope family which is found in the Alps at a height of more than 8,000 feet above the sea-level. It is like the goat in its looks and habits. Its horns are peculiar, rising straight from the crest of the head for some inches and curving backward suddenly so as to form a pair of sharp hooks. Its hind-legs are longer than its fore legs, so that in descending mountains its hind feet catch rough places and its fore feet are set close together and pushed forward. It is acute in scenting man at a distance, and footprints in the snow will alarm the wary animal. The chamois live in herds, and when grazing they post one of their number to give the alarm; but if danger comes, they see it so quickly that often they make off before the signal is given. The skin of the chamois is much valued for making chamois leather, which combines softness with tenacity. "Chamois leather," or wash-leather, is now made from the flesh side of sheep skins.

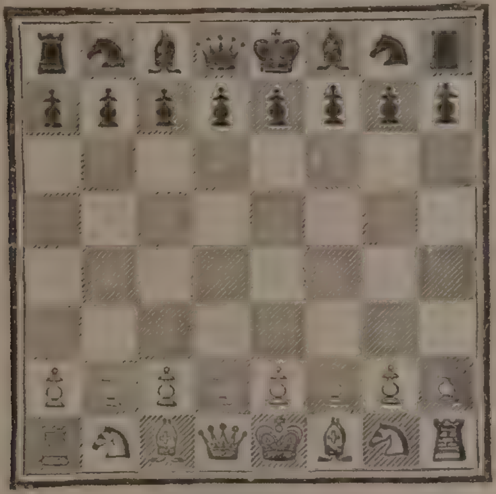
Champagne′. [Fr.] A light wine, of several kinds, originally made in Champagne, France. This wine contains much carbonic acid gas, which causes effervescence when poured out.

Char′coal. [AS.] The most common form of carbon. The purest form is animal charcoal, called also *bone black* and *ivory black*. It is prepared by heating bones in a vessel nearly closed; the volatile matters are driven off, and bone black is left. It is used in purifying sugar and in the filtration of water. Wood charcoal is prepared by burning wood with a limited supply of air; only the more volatile constituents burn away, and the greater part of the carbon is left. Charcoal so prepared is black and brittle; it retains the form of the wood from which it is derived. Other forms of charcoal are gas-carbon, coke, and lamp-black. It has a remarkable power of absorbing gases, and has therefore valuable uses in medicine and as a substance for respirators. It is used as a deodorant, and as a disinfectant in hospitals and dissecting-rooms. It is also largely employed in the manufacture of gunpowder.

Chart. [L., *charta*, paper.] A map especially for the use of seamen. *Heliographic*, of the sun; *selenograpic*, of the moon.

Cheese. [AS., from L. *caseus*, cheese.] Curd of milk pressed hard. By adding rennet to milk, the nitrogenous substance called *casein* is made to curdle or coagulate; and it is separated from the whey by straining. The curds are pressed into shape in moulds and then dried. The best cheese is made from new milk—that is, from milk which has not lost its cream. The richest kind of cheese made in England is called *Stilton cheese;* it is made from milk to which cream has been added. *Cheddar cheese* is made from good new milk, while some other kinds are made from milk partly or fully skimmed of its cream. *Gruyere cheese*, made in Switzerland, is flavored with herbs. *Roquefort* is made from the milk of sheep and goats. Skim-milk cheese is a flesh-forming food, because it consists chiefly of *casein;* new-milk cheese is a flesh-forming *and* a heat-producing food, because it contains the casein and *also* the milk-fat or cream. One hundred pounds of cheese contain 30 lbs. of fat. Cheese in America is principally made in large factories, largely in New York State. The annual production in the United States is about 50,000,000 pounds. (See *Curds.*)

Chem′istry. [Gk.] The Egyptians, Greeks, and Romans were acquainted with many of the substances known to us at the present day, and also with the method of their preparation; but among those nations nothing was known of chemistry as a science. During the Middle Ages the alchemists experimented with numerous substances, more especially with such as were of a metallic nature, with the object of turning them into gold. In this way they discovered some important substances. Dr. Black's discovery of "fixed air," or carbonic acid, in 1756, led the way to the discovery of other gases by Cavendish, Rutherford, Priestley, Scheele. The discovery of oxygen by Priestley in 1774 enabled Lavoisier to explain the true nature of combustion. Next came the discovery of the laws of chemical combination by Dalton, and the publication of his atomic theory. Sir Humphrey Davy, by decomposing potash and soda in 1807, laid the foundation of electro-chemistry. The most important advances in chemistry were made during the nineteenth century, and in organic chemistry progress has been very rapid.



CHESS BOARD.

Cheroot′. [Tamil.] A kind of cigar originally made in Manilla; now a cigar of inferior or adulterated tobacco.

Cher′ry. [Fr., from Gk. *kerasos*] A tree of the Prune or Plum family bearing a red stone-fruit, which is much esteemed for dessert purposes and for conserves. There are several hundred varieties of the common garden cherry. The wild or black cherry of the United States is a beautiful and useful tree, its wood being much esteemed by cabinet-makers. Its fruit is not very good for eating. Cherry brandy or rum is brandy or rum in which cherries have been steeped.

Chess. [Fr., from Pers. *shah*, a king.] A game played by two persons on a board divided into squares. Each player has a king, a queen, two bishops, two knights, two castles, and eight pawns. The king, when made prisoner or checkmated, is assumed to be dead, and the game ends. There is no game requiring more skill.

Chest′nut. [Fr., from Gr. *kastanon*, a chestnut.] A tree with white or red flowers like spikes, and a fruit of a reddish-brown color, enclosed in a green prickly husk, the nuts being covered by a thick firm skin. The timber is hard and lasting, and used for ornamental work, furniture, etc. The bark is used in tanning. The chestnut is found in Europe, America and Japan. The European chestnut bears a much larger fruit than the American, but not so sweet. Its starchy contents are used for bread-making in Italy.

Chick′weed. The name of several weeds, especially *Stellaria media*, the seeds and buds of which are a favorite food of small birds.

Chic′ory. [L. *cichorium.*] A common European plant, known also as *succory.* It is somewhat like the dandelion, and a substitute for coffee is obtained from its root by roasting and grinding. It is mixed with coffee or used by itself. Chicory can easily be distinguished from coffee by placing some of it in water. It rapidly sinks, and colors the liquid a reddish-brown; but genuine coffee floats, and does not color the water. The chicory or succory plant grows on limy soils and by the dusty roadside. It has large bright blue flowers and toothed leaves. It is introduced in America where the blue and white-flowered varieties are common.

Chil′blain. [AS.] A swelling produced by the exposure of the hands or feet to cold and sudden heat.

Chimpan′zee. [Fr.] A West African ape which is more like man in some ways than any other ape. When full grown it is 4 feet high. It has no hair on the hands and face, and none on its large rounded ears. Its arms are shorter than the orang's, but fall below the knee. Its habit in walking is to bend forward and rest on the hands. When tamed it has been taught to eat food with a spoon at a table, but in the wild state it lives among the branches of trees near the ground.

Chi′na. A fine kind of ware first made in China, and first brought from China in the seventeenth century. (See *Porcelain.*) China ink is India ink.

Chinchil′la. A South American rodent like a squirrel, with five-toed fore feet and four-toed hind feet, and a large bushy tail. Its soft fleecy fur is much valued. It is a shy animal, with nocturnal habits.

Chine. [Fr.] A piece of the backbone and surrounding flesh of an animal cut for cooking.

Chintz. [Hind.] Cotton cloth printed with colored patterns, and often glazed. (See *Cotton.*) Chintz is used for bed-hangings and to cover furniture.

Chip′munk. A small American squirrel, marked with black stripes on a yellowish-brown skin; thence called striped squirrel; also ground squirrel, since it lives in the ground, in which it burrows and makes its nest. It lives on seeds and nuts, which it carries in cheek pouches and stores up in its holes. It is also called cheeping squirrel, from the noise it makes. Its worst enemy is the weasel, which follows it into its burrow.

Chlo′ral. [Gk.] A chemical substance prepared by acting on pure alcohol with dry chlorine gas. It is a limpid, colorless liquid. With water it forms *chloral hydrate*, a crystalline substance, largely used for the purpose of obtaining quiet sleep.

Chlo′rides. [Gk.] Salts formed when chlorine gas unites with metals. The only chloride which occurs plentifully in nature is sea, or rock-salt, which is a chloride of sodium.

Chlo′rine. [Gk. *chloros*, light green.] One of the non-metallic elements, discovered by Scheele in 1774. It is prepared from common salt by the action of sulphuric acid on manganese dioxide. It is a transparent gas of a greenish-yellow color, which does not occur free in nature. United with the metals sodium, potassium, and magnesium, it forms the chief salts of sea-water. Chlorine is a powerful bleaching agent, and this action depends upon the power which it possesses of combining with the hydrogen of water, and so setting free the oxygen.

Chlo′roform. [Gk. *chloros*, light-green, and *formyl.*] A heavy, colorless volatile liquid, possessing an agreeable odor, like ether; it has a sweet though acid taste; it is only slightly soluble in water; it dissolves sulphur, phosphorus, gutta-percha, iodine, and fatty and resinous substances. It was discovered in 1831 by Guthrie in America, and attention was first called to its anæsthetic properties by Flourens in 1847, regarding its effects on animals; and soon after this Simpson of Edinburgh introduced it as an anæsthetic in medical practice. Its effect on the nervous system is to cause a suspension of voluntary motion and of sensation, while respiration and the action of the heart are continued.

Chlo′rophyl. [Gk. *chloros*, light-green; *phyllon*, leaf.] The substance which gives plants their green color. It is a resinous substance, whose chemical composition is not exactly known.

Choc′olate. [Span. or Aztec.] A sweetmeat made from cocoa. (See *Cocoa.*)

Chol′era. An epidemic intestinal disease, which seems native to Southern Asia, and has at various times swept with terrible destruction of life over Europe and America. It produces severe and painful cramp, often quickly followed by death. It is now known to be due to a form of bacteria (*q. v.*), and recent epidemics have been checked by sanitary measures.

Chough. [AS.] A bird of the Crow family, of a black color, and with a long, slender, curved bill and red legs. The Cornish chough is the sea-swallow.

Chrome or **Chro′mium.** [Gk.] A hard, fusible, and brittle metal. Potassium chromate and lead chromate (chrome red) are used in dyeing and calico-printing. Chrome yellow is used by painters. Pure chromium is the most difficult to fuse of all the metals. Its compounds are much used in the arts, in painting and coloring. It forms four compounds with oxygen, and its chief ore is chrome ironstone, found in America, Sweden, and the Shetlands.

Chronom′eter. [Gk. *chronos*, time; and *metron*, a measure.] An instrument for the exact measurement of time. The name is commonly applied to a portable time-keeper, in opposition to a clock, which is stationary. In chronometers the balance-wheel is compensated, so as not to be affected by changes of temperature.

Chrys′alis. [Gk. *chrysos*, gold.] The pupa or yellow form which many insects take before they get their wings. When the larva of the butterfly leaves off eating, it enters the chrysalis state. Wrapped in a dry skin, and hanging head downward, suspended or tied by a silken thread, it remains seemingly dead. A marvellous change is going on, and when the skin bursts a fullgrown butterfly appears.

CHRYSALIS.

Chry′santhemum. [Gk. *chrysos*, gold; *anthemon*, flower.] A family of perennial plants, consisting of the ox-eye daisy, feverfew, but chiefly the garden chrysanthemum, of which there are 1,500 varieties, some of them of great size and beauty. Some have their petals rolled up like quills. This flower was introduced from China or Japan about 1764.

Ci′der. [Fr.] A drink made from the juice of apples. Besides being used as a beverage, it is used for making vinegar and cider-brandy.

Cigar′. [Span.] A small roll of dried tobacco leaves for smoking. Originally a kind of tobacco made in Havana, Cuba, where the finest are made. In the United States very many million cigars are made annually, and large numbers are also made in Havana.

Cigarette′. [Fr.] A roll of loose fine tobacco rolled in paper for smoking.

Cincho′na or **Cascaril′la.** A tree growing in the Andes and in the East Indies, from the bark of which is procured Peruvian bark, which yields quinine, a substance of great medicinal value in fevers. In the 17th century the wife of Count Cinchon, Viceroy of Peru, was cured of fever by the bark of this tree, hence the name.

Cin′nabar. [L. *cinnabaris.*] Red sulphide of mercury, or vermilion. It occurs as crystals. It is used as a paint and in medicine. *Cinnabar grecorum* is a red resin used for coloring varnishes, and known as dragon's-blood.

Cin′namon. [Heb. *qinnamon.*] The bark of a kind of laurel tree found in Ceylon. It is aromatic, pungent, and used as a cordial. With cassia it yields the oil of cinnamon. Cinnamon is used in medicine, cooking, and confectionery.

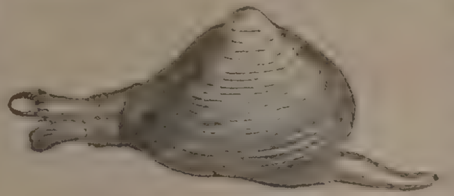
Cir′cle [L. *circus.*] A plane figure contained by one line called the circumference, and such that all straight lines drawn from a point within the figure, called the centre, to the circumference are equal. Any straight line drawn through the centre of a circle, and terminated both ways by the circumference, is called a *diameter*. A line from the centre to the circumference is called a *radius*. Two diameters at right angles to one another divide a circle into four equal parts called quadrants. Each of these is divided into 90°, so that the whole circumference of a circle contains 360°.

Circula′tion. [L.] The movement of the blood through the vascular organs of animals. In birds and mammals, the air-breathing animals, the circulation is double (pulmonary and systemic), and is carried on through the heart (*q.v.*), the arteries, and the capillary tubes. In reptiles the heart consists of two auricles, and one ventricle, and there is an incomplete double circulation. In fishes, which are water-breathing animals, there is a simple circulation—the heart consisting of a single auricle and a single ventricle, the blood taking in oxygen and giving out carbonic acid in the gills instead of the lungs, which are absent in fishes.

Cis′terns. [L. *cisterna*; from *cista*, box, chest.] Receptacles for water. They are generally square or round in shape, and are commonly lined with lead. Soft water acts upon lead, dissolving it and forming carbonate of lead, which is a poisonous substance. It is the bright, clean lead which is affected. After the lead has become dull, or crusted over, the water can no longer dissolve it.

Cit′ric Acid. An acid which is found in lemon juice, and which also occurs along with tartaric and malic acids in many other fruits—such as oranges, cherries, currants, garden rhubarb, etc. It is prepared from lemon or lime juice. It crystallizes in large colorless crystals, which dissolve freely in water. When dissolved in syrup it is kept for use in the manufacture of lemonade. It is used by calico-printers, and in the dyeing of silk.

Cit′ron. A fruit of the same family as the lemon and orange, and of the shape of a lemon, but larger and rougher, while its juice is not so sour. It is a native of the south of Europe and Asia. A favorite confection is made of its peel preserved in sugar, and oil of citron is made from the peel and the leaves. Citric acid is sometimes made from its juice.



Clam. A bivalve shell-fish found in many seas, one species being the common edible clam abundant in the United States, and much used as food. There are many varieties—as long clam, round clam, sea clam, little-neck clam, and giant clam. The long clam burrows in the sand with the muscular organ usually known as its foot. Its shell grows at the hinge, and increases as fast as the animal grows. The giant clam is an inhabitant of the China Sea and South Pacific, and is the largest known bivalve mollusc, the shells being known to measure 2 feet in length and weigh 500 lbs.

Clar′et. [Fr., from L. *clarus*, clear.] A wine of a red color; first applied to Medoc wines, and then to red Bordeaux wines.

Clar′inet or **Clar′ionet.** [Fr.] A wind instrument blown by a single reed, and usually a leading instrument in a military band.

Clarion. [Fr.] A trumpet with a loud, clear sound.

Claw. [AS.] The toe nail of a beast or bird. The claw of the lion may be unsheathed or put out, and withdrawn or sheathed. The claws of the dog, which catches its prey with its teeth, are blunt, and cannot be withdrawn. The hawk and the eagle, that seize their prey alive, have all their toes or claws long, curved, strong, and sharp; but the vultures, that feed on dead animals, have short hind toes, nearly flat front ones, and all very weak. The bustard has no hind toe. Each foot of the spider has three claws: the middle one is bent over for clinging to the web; the other two have teeth like a comb, and are used sometimes for cleansing the limbs and webs.

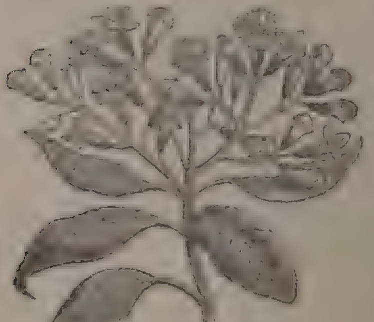
Clay. [AS.] A fine-grained, sandy substance, derived from the decay of aluminium silicates. It is white when pure, but it is generally mixed with impurities which impart to it various shades of gray, brown, red, purple, or blue. When dry it is friable, and when wet can be kneaded between the fingers. When shaken with water it becomes mud. It is largely used for making bricks and earthenware.

Clem′atis. A climbing plant of many kinds, found in most temperate regions, with beautiful flowers, having feathery styles that enlarge in the fruit.

Clock. [Celt.] A machine for measuring time, with wheels moved by weights or springs. It is usually made so as to tell the hour by the stroke of a hammer on a bell. An *alarm clock* has a mechanism to ring a gong at a set time. An *astronomical clock* has a compensating pendulum. An *electric clock* is regulated or moved by electricity. A *sidereal clock* keeps sidereal time, and is fitted on large telescopes.

Clouds. When vapor is condensed high up in the air, it receives the name of cloud. The three fundamental forms are—*cirrus*, *cumulus*, and *stratus*. The *cirrus* consists of fibrous, wispy, or feathery clouds, placed in the highest region of the atmosphere. *Cumulus* (heap cloud) consists of rounded masses commonly seen in the sky in summer, supposed to be formed by columns of ascending vapor, the upper portions of which have condensed. *Stratus* is a horizontal sheet, frequently formed at sunset, but which disappears again at sunrise. These primary forms combine into intermediate forms, and are all combined in the *nimbus* or storm-cloud, that from which rain falls. The average distance of clouds from the earth is between one and two miles, but streaky, curling clouds are often six or more miles high.

Clo′ver. A leguminous plant grown for fodder. It is one of the most useful crops a farmer can grow. Its roots collect and store up a large amount of plant-food. The common broad or red clover is the kind most generally grown. The white or Dutch clover grows in good pasture land; each stem bears a single head of flowers. Sheep are very fond of it. Crimson clover gives one excellent hay crop. Swedish clover, on the contrary, will grow strongly for two or three years in succession, yielding a very fair crop each year. It has a pink flower, and bears cold and wet well.

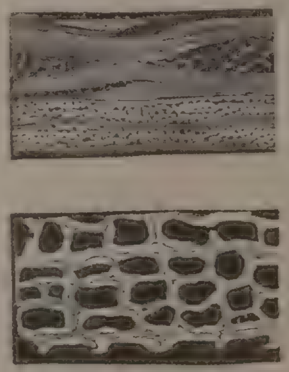


CLOVES.

Cloves. [Fr.] The clove tree is of the Myrtle order, and is a native of the Spice Islands, but is now cultivated in Zanzibar and the West Indies and other tropical countries. It resembles the laurel, and grows to a height of from 15 to 40 feet. Its leaves are large and oblong, its flowers small and dark red, and its fruit is like an olive in shape, but red like the flowers. The fruit, when dried, is known as "mother of cloves." The cloves used for flavoring are the unopened flower-buds. These buds become dark-brown, and look like nails; and so they take their name from *clou*, the French word for nail. The little ball which seems to form the head of the nail is really composed of the petals of the flower, and will unroll if soaked in water. Cloves are used for their strong aromatic taste in flavoring food such as puddings, cakes, and preserves. *Oil of cloves* is useful in medicine, and to scent toilet soap.

Coach. [Fr., from Gk. *conche*, a shell.] A framework with cover and seats, set on wheels, for carrying people, having doors in the sides and an elevated seat for the driver. *Mail coaches* and *tally-ho coaches* often have four seats inside and seats for twelve outside.

Coal. [AS.] A black substance (consisting mainly of carbon), dug out of the earth, which burns and gives heat. Coal is of compact but brittle structure, and found in seams and beds, and is the remains of a luxuriant vegetation which flourished on the earth's surface during the Carboniferous age, and to some extent in other geological periods. It is supposed to be due to the action of heat and pressure upon great accumulations of this material. There are many varieties of coal, distinguished from one another by the varying proportions of the different constituents. *Bituminous coal*, such as is in general use, contains from 75 to 80 per cent. of carbon, 5 to 6 of hydrogen, and 10 to 12 of oxygen. *Anthracite* is the most completely mineralized variety, and contains about 90 per cent. of carbon, the gases oxygen and hydrogen having been driven off. *Cannel coal* and *lignite* contain less carbon and yield more ashes than those named. The present yearly output of coal in Great Britain and the United States is about 200,000,000 tons in each. Other countries yield much less. Some of the mines are very deep.

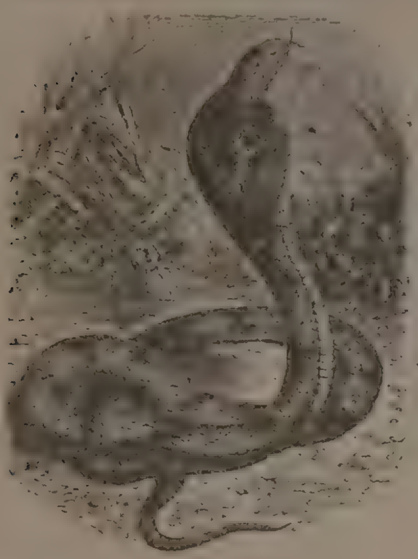


COAL UNDER THE MICROSCOPE.

Coal-tar. A thick black liquid, obtained during the distillation of coal for the manufacture of illuminating gas. This substance yields madder, a coloring substance formerly obtained from the roots of a plant. One ton of cannel coal when distilled leaves 12 gallons of coal-tar, from which are produced 1 lb. of benzene, 1½ lb. of carbolic acid, and a number of other substances used for dyeing purposes. From these substances there may be obtained 10 distinct yellow colors, 12 orange, 30 red, 15 blue, 7 green, 9 violet, besides a number of browns, and an indefinite number of blendings.

Coat. [Fr.] An outer garment for the upper part of the body, chiefly worn by men.—*Coat of arms* (translation of *cotte d'armes*, small coat worn over armor), the heraldic bearings of any one.

Co'balt. [Ger. *kobalt;* from *kobold*, a goblin.] A reddish-white metal, very tenacious, and very difficult to fuse; occurs in small quantities in meteoric stones, and is usually found combined with arsenic and sulphur. It forms three compounds with oxygen. One oxide imparts a deep-blue color to glass. This glass, reduced to powder, is used in producing the blue colors in porcelain, pottery, glass, encaustic tiles, etc. Chloride of cobalt diluted forms sympathetic ink.


COPRA DE CAPELLO.

Co'bra de Capel'lo. [Port.] The hooded snake, a very venemous serpent found in India. Its hood is formed by the skin of its neck, which it can draw over its head. Ordinarily it is like other snakes, but when going to strike the head broadens out. It is usually carried about by snake-charmers; but in India many people die from its bite every year.

Coch'ineal. [Span.] A dye got from the dried bodies of insects found on a cactus in Mexico, Central America, etc., and yielding carmine red.

Cock. The male of a hen, particularly of domestic fowls; also a valve for drawing liquids; and a small pile of hay. *Weathercock* is a vane in the shape of a cock.

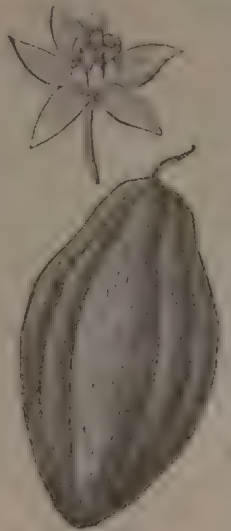
Cockatoo'. [Malay.] A bird of the Parrot family, having a short, strong, and much-curved beak and crested head. Among the many varieties are the sulphur-crested, broad-crested, and the great black cockatoo of Australia.

Cock'chafer. A beetle; called also may-bug or dor-beetle. (See *Beetle.*)

Coc'kle. [Celt.] A kind of shell-fish, a bivalve with radiating ribs, used in Europe as food; also a weed among corn—applied to the corn-rose and darnel.

Cock'roach. An insect of the straight winged family, of which there are many species, some living in the woods under stones, leaves and rotten logs; others, infesting houses, where they eat both animal and vegetable food, swarming out of their holes at night. There are two kinds common in houses, one small, and one quite large. They may be destroyed by poison or driven away by borax, which they do not like.

Co'coa. The product of the fruit of chocolate tree, a native of Mexico, Central America and Brazil. It is a handsome tree, 10 to 20 feet high, and is sheltered when growing by larger trees. It commences to bear fruit in the third year. The fruit is cucumber-shaped, and consists of a hard outer part from 6 to 8 inches long, and a soft white pulp, which protects numerous seeds almost as large as almonds. The seeds are cleaned, dried, and ground by hot rollers to a paste or powder, which is known as rock or flake cocoa. Sometimes they are broken up by rollers into pieces, which are called cocoa nibs. Mixed with sugar and spices, flake cocoa is known as chocolate, and is used in cakes and sweetmeats. About one-half of the weight of the seeds is due to a fat called cocoa butter; much of this is removed in making chocolate. The active principle of cocoa is theobromine, a nitrogenous product.


COCOA.

Co'coa-nut. The nut of the cocoa-palm. The tree grows in tropical countries to a height of from 60 to 80 feet, and is without branches, the leaves and clusters of nuts being at the top. The nut has a milky fluid, and a white meat of albumen which yields an oil. The cocoa-palm is found in all parts of the tropics, and is a very useful food-plant, while its nuts are used in large quantities in temperate regions for confectionery and other purposes. (See *Palm.*)

Cocoon'. [Fr.] The case spun by insects to cover them, especially the oblong case of the silkworm in its chrysalis state, which is formed of threads of silk spun by the insect in its larval state, and from which the silk of commerce is prepared.

Cod. [Goth.] An important sea-fish, used as food, and taken in immense quantities on the northern coasts of Europe and North America. It is very abundant and large on the Banks of Newfoundland. There are several kinds—shore-cod, in shallow water; rock-cod, often mottled. Cod-liver oil is obtained from the liver of the cod-fish, and is used extensively in medicine to supply the body with fat.

[illegible]

Cof′fee. The fruit of a tropical evergreen tree from whose beans is prepared a favorite beverage. In its wild state the coffee tree grows from 20 to 30 feet high, but when cultivated is not allowed to grow more than 8 or 10 feet. Its flowers are small, white, and fragrant-smelling, and grow in thick clusters. Its berry or fruit is like a cherry, and contains two seeds or beans. The first crop of fruit appears when the trees are three years old. The plants bear fruit for many months, so that several crops can be gathered in a year. The berries are dried; then the beans are removed by rollers from the pulp that surrounds them. Coffee thrives in moist, warm countries, as Abyssinia, Arabia, Brazil, Ceylon, Java, and the West Indies. To *make* coffee, the beans are roasted and then ground to a fine powder. Boiling water is then poured on the ground coffee; this dissolves a substance called caffein. The best coffee is the *Mocha*, grown in Arabia. *Java* coffee is also of fine quality. There are many other varieties, differing greatly in flavor. Coffee is used very largely in the United States.

Cog. [Celt.] A tooth or cam on the rim of a gear-wheel for imparting or receiving motion. A cog-wheel is a gear-wheel with cogs or teeth.

Co′gnac. A kind of French brandy, so named from the town Cognac.

Coin. [Fr., from L. *cuneus*, a wedge.] A piece of metal stamped to be used for money. It is round, flat, bright, hard, and durable. Alloys of the metals are generally used. They are melted into ingots, rolled into ribbons to the required thickness, and punched, rounded, milled, and stamped with a die and counter-die, and weighed.

Coke. [O.E.] Mineral coal from which bitumen, sulphur, or gas has been extracted by roasting in a kiln or oven, or by distillation, as for gas. It is smokeless, and is largely used in steel works and in foundries.

Cold Storage. A method of preserving food substances by keeping them in a low temperature. Freezing machines are used to chill the air for this purpose. This system has come widely into use, cold storage rooms being provided in all our large cities in which vegetables, fruits, and meats can be kept for any desired length of time. They are of much use in markets to preserve the material left unsold. Cold storage meats need to be used soon after being thawed out, as they spoil more quickly than unfrozen meats.

Cold Wave. The name given in the United States to spells of severe depression in temperature, usually the effect of anti-cyclonic conditions arising in the great plains of western Canada.

Col′lie. A Scotch shepherd dog remarkable for its intelligence. There are two breeds, rough-haired and smooth-haired.

Collo′dion. [Gk. *kolla*, glue; and *eidos*, like.] A substance formed when gun-cotton is dissolved in a mixture of alcohol and ether. It is used in photography for the purpose of forming a thin film on the glass which is to receive the silver salts on which the image is formed. Combined with camphor it forms celluloid (*q.v.*)

Cologne′ or **Cologne Water.** A perfume made of alcohol flavored with essential oils. The oils of many flowers are used, though much of the cologne sold is a cheap imitation of the real article. It was named from the city of Cologne, where it was first made.

Co′lon. [Gk.] The mark (:) used at the end of a clause complete in itself and nearly independent. *Semicolon*, the mark (;) used to indicate a separation more distinct than the comma.

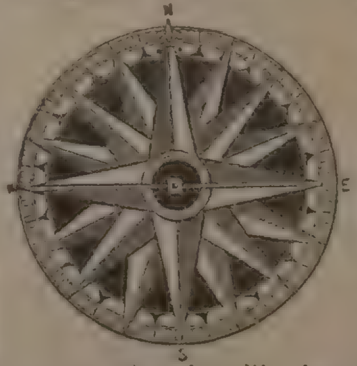
Col′o′r. [L.] The term used to express the different sensations which are produced when light of different kinds enter the eye. When ordinary white light is passed through a prism (*q.v.*), it is decomposed into seven colored rays—violet, indigo, blue, green, yellow, orange, red. There are three primary color sensations—red, green, and violet; and the blending of these in different proportions gives rise to all the other colors.

Col′umn. [L.] A long round piece of stone, wood, or metal set on end to hold up or adorn a building. It is usually ornamented, and composed of base, shaft, and capital. A clustered column is a column composed of several smaller columns. (See *Capital.*)

Com′ets. [Gk. *kome*, hair.] A wandering class of heavenly bodies. As seen through a powerful telescope, a comet consists of an ill-defined mass of light called the head, which is much brighter towards the centre, presenting the appearance of a *nucleus* like a star or planet. Surrounding the nucleus there are certain definite layers of luminous material, which seems to unite behind the head, and from which a luminous train called the tail proceeds. The direction in which the tail points is always opposite to that of the sun. There are many comets revolving round the sun in very elliptic orbits, almost touching the sun at one end of the orbit and very distant at the other. Other comets are supposed to come from the depths of space. Some of them break up into fragments and form meteoric rings.

Com′mon. [Fr.] A piece of land to which all have right for pleasure or pasturage.

Com′pass, Mar′iners. A magnet (*q.v.*), when suspended horizontally, always points in a direction nearly north and south, and on this principle has been constructed the mariner's compass, an instrument of great value to sailors, as showing them in what direction to steer. In the compass the needle is fitted up in such a way that it will always remain horizontal whether the ship is pitching or rolling. The needle is firmly attached to a circular card (called the compass card), which is divided into thirty-two equal parts by lines drawn from the centre to



the circumference. The mariner's compass was brought from China to Europe during the thirteenth century.

Compress′ed Air. One of the first important uses of compressed air as a source of power was in the excavation of the Mount Cenis and the Hoosac Mountain railroad tunnels, in which air compressed by water power was conducted by pipes into the depth of the tunnels. Another important use is in the air-brake on railroad trains. It is used for many other purposes, an important one being the propulsion of street cars by compressed air motor engines, and another one the driving of letters through tubes from the central to the branch offices of some large cities.

Concerti′na. [Ital.] A small musical instrument like an accordion, with bellows, having reeds inside and keys and handles on each of two six-sided heads.

Con′crete. [L.] A hard building material made of gravel, pebbles, sand, and pieces of stone held together by cement (*q.v.*), or tar, used for sidewalks, foundations, and submarine structures.

Con′dor. [Span.] The largest of known vultures. It is of the vulture kind, and lives on the highest Andes, building its nest 15,000 feet above the level of the sea. In winter these birds descend in groups to feed on the low grounds and the seashore. They possess the instinct of discovering a dead or dying animal at a very great distance, and though they feed principally on carrion they will sometimes seize living animals. The condor is usually 4 feet long, and has 9 feet spread of wing.

Cone. [Fr.] A figure with a round base tapering to the top or vertex. Also the fruit of firs, cedars, and other trees known as conifers, composed of woody scales, each of which has one or two seeds at its base.

Congou. [Chin.] Black tea of higher grade, finer leaf, and less dusty than bohea. It means "well worked" In the United States it is called "English breakfast tea."

Constella′tion. [L. *con*; and *stella*, a star.] The name given to the artificial groups of stars. The figures of men and animals were of old supposed to be outlined in the sky, and mythological names were given to them. The stars in a constellation are distinguished by the Greek letters *a*, *b* *g*, *d*, etc.; as *a* Tauri (*Alderbaran*), first star in Taurus, or *g* Orionis (*Bellatrix*), third star in Orion.

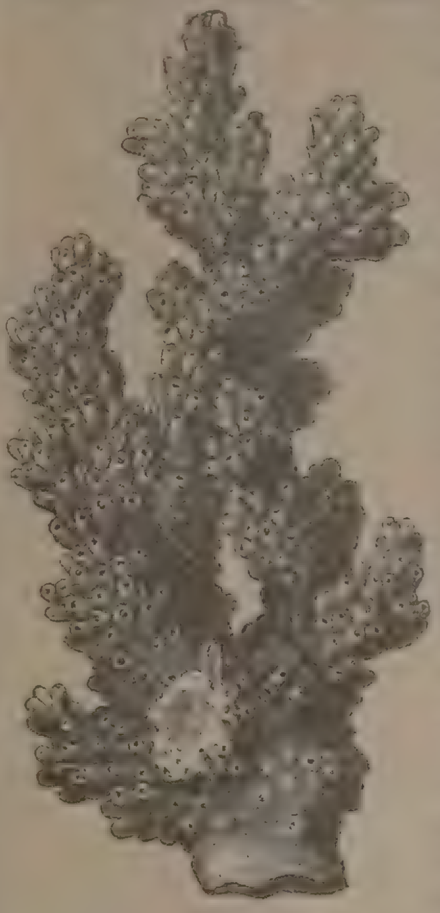
Convolv′ulus. [L.] A monopetalous plant with twining stems, including the bindweed, with flowers beautifully colored. Morning glory, and sweet potato belong to the same family, and are first cousins to convolvulus.

Co′ny. [O.E.] A kind of rabbit. The cony of Scripture is the daman or rock-rabbit.

Coot. [Du.] A short-tailed water bird. It is the common mud-hen of the marshes, and is interesting because of its lobed foot, which has flaps on the sides of the toes. The European coot is named the bald coot, in allusion to the bald or bare patch on the front of its head. There are several American varieties.

Co′pal. [Span.] A resinous substance consisting of the dried juice of various trees growing in Zanzibar, Madagascar, India, and South America. In Africa also it is dug from the earth where forests once stood. It is sold in rounded masses, and in appearance resembles amber. After being melted, it becomes soluble in alcohol; and in this way varnishes and lacquers are prepared.

Cop′per. [O.E.] A metal, so called from the island of Cyprus, where the Greeks and Romans obtained it. Metallic copper is found in the United States, but it is generally prepared from its ores, of which there are several, found in most European countries, as well as in North and South America, Africa, Australia, and Japan. The principal localities in the United States are Michigan, Montana, and Arizona. It can be obtained from its ores at a comparatively low temperature; which accounts for its extensive use in the early stages of civilization. Metallic copper possesses a deep, red color, takes on a brilliant polish, is very malleable and ductile, and as a conductor of heat and electricity it comes next to silver. It is not acted on by water, nor by exposure to dry air, but in moist air it becomes coated with green carbonate. Red oxide of copper is used for coloring glass. Blue vitriol is the sulphate, and is much used in dyeing and in the preparation of paints. Copper mixed with tin is bell-metal, and with less tin is bronze; with zinc, it is brass or pinchpeck.


CORAL.

Cop′per-plate. A plate of copper on which pictures or writing are engraved. In printing from copper the lines are filled with ink, the surface is wiped clean, and the impression taken by pressing paper under the roller of a press.

Cor′al. [*Animal.*] A minute creature, of low organization, which builds itself a framework of carbonate of lime, which is lined with the fleshy body of the living animal. Corals live in colonies in the warm seas, and their combined shells form great masses of coral rock, which in some regions become reefs or islands. They cannot exist at a depth greater than from 90 to 120 feet, and they also die by exposure to the air, so that from a depth of about 100 feet they work upwards until they reach low-water mark; and when their progress is thus stopped in the upward direction, they begin to grow outwards, increasing on the outer edges of the reef, where they find food, carried by the ocean currents, most abundant. The action of the waves and the chemical action of the sea-water cement the materials into a firm steep slope. When a reef has been built on a shelving sea-bottom near a continent or round a volcanic island, the space of water inside is called the *lagoon channel*. When the reef has been built on a submarine ridge or peak, it forms a circular island, called an *atoll*, with a broad lake of sea-water inside, called a *lagoon*.

Corduroy′. [Fr.] A thick cotton cloth with the surface in ridges.

Cork. [Span.] The bark of a tree similar to the oak in appearance. The trees grow for 15 years before the cork is gathered, and some trees live over 150 years. They are found in Spain, Italy, and Portugal. The cork forests of Spain cover 620,000 acres. The bark is cut lengthwise, and stripped off in sheets in July and August. After a year new bark forms, and the process is repeated every three or four years. The sheets are soaked in water and placed under weights, and when dry are ready for use. These sheets are cut into corks by machinery. They are first cut into narrow strips, then they are cut into different-sized pieces for bottles, and then rounded. Cork is used for stoppers because it is elastic, so that after being pressed into the neck of a bottle it fills the space and allows no air to pass in nor any of the contents to escape. Cork is also used for soles of slippers and in the making of life-boats and life-preservers.

Cor′morant. [Fr., from L. *corvus marinus*, or sea-crow.] A sea-bird which greedily devours fish. It is about the size of a goose, and has a yellowish skin, which, hanging loosely under its bill, forms a wide pouch. The legs are strong and black, and the webbed feet have one claw, indented like a saw. The cormorant is wont to fish with its head under water, and it has such a clear eye and dives so well that it is able to be under the waves till it catches its fish. Fish after fish will disappear into the skinny pouch under the bill. It is said a cormorant can devour 4 lbs. of fish a day, which is half its own weight. If a fish is too large to swallow, it will toss it up in the air, and catching it again head foremost bolt it more easily. In China, the cormorant is trained to dive and catch fish, but a strap beneath its throat prevents it from swallowing it; each time the fish is taken from it, the bird returns to its work till the owner is satisfied.

Corn.. [AS.] In Scotland, applied to oats; in the United States, to maize; in England, to wheat; in Russia, to rye and barley. A collective name for the grains. The corn-producing grasses furnish excellent food for both man and beast. They contain a great deal of starch, and also a fair proportion of such flesh-formers as gluten and fibrin. Wheat and oats are superior as food to barley and rye, containing more flesh-forming matter and less water. Wheat is, as a rule, too expensive a food to give to cattle, but the bran, which consists of the outer coating of the grain of wheat, is a very useful food for cattle and horses. It is rather indigestible, and should first be scalded in boiling water. Oats and maize are largely used for animal food.

Cor′net. [Fr.] A wind instrument made of brass, furnished with valves moved by small pistons or sliding rods, and used in bands and orchestras.

Corolla. [L.] The colored envelope of a flower which surrounds the organs of fructification, consisting of one or more leaves called petals.

Cot′ton. [Fr.] The cotton plant is an annual, and belongs to the same order as the marshmallow and the hollyhock. Originally it was a native of Asia, but it is now cultivated in almost all warm countries, especially in the southern portions of the United States, India, China, Egypt, Brazil, and the West Indies. The plant grows to various heights in different countries, varying from 2 or 6 feet to 9 or 10 feet. Its leaves are dark green, and its flowers are large and usually white or bright yellow. As each flower drops a seed-pod takes its place. These pods are three-sided, and about the size of a walnut. When ripe these pods burst open, showing within a mass of white fibres, which are the snowy balls of cotton. The pods are gathered and the cotton taken out and dried. The seeds are removed by the cotton-gin, a machine with revolving cylinders, covered with sharp teeth, which tear the seeds from the cotton. The cotton is then pressed into large bales. In making cotton cloth, the cotton is thoroughly cleaned by a cotton-picker, carded, and spun into long, fine threads for the warp or for cross-threads. The spinning-wheel formerly did this, one thread at a time. Hargreaves invented "the jenny," by which eight threads could be produced at the same time. Continued improvements have made the machinery so perfect as to render the process of spinning easy and rapid. Sewing cotton is made by twisting together several of the fine fibres, and winding on reels or bobbins. The weaving of cotton consists in crossing and recrossing the threads in a loom to form cloth.

INSIDE OF PICKER

The threads which extend the length of the cloth form the warp; the threads crossing from side to side form the woof or weft. The fabrics made from cotton include gingham (where the yarn is dyed before being woven), cambric, muslin, lawn, calico, chintz (a kind of heavy calico, gaily colored), corduroy, velveteen, wincey, and other stuffs mixed with silk or wool.

Cotton-Seed Oil. The seeds of the cotton plant, which are left in large quantities after the extraction of the cotton fibre, have become valuable as a source of oil, which, when clarified, is of a clear golden-yellow color. It is used as an adulterant or a substitute for linseed, sperm, lard, olive, and almond oil, for cooking in place of lard or butter, and for other purposes. A large proportion of the salad oil used in the United States is Cotton-Seed oil. The "cake," which is left after the oil is pressed from the seeds, is used as a fodder for cattle and as a fertilizer.

Cow. [O.E.] A hoofed, herbivorous animal, which is one of the most useful of all animals to man. It is somewhat smaller than the horse, has long, smooth horns, large, gentle eyes, and a tufted tail. Its hoofs are cloven. Like the horse, it is a grass-eater; and, like the sheep, it chews the cud. (See *Digestion*.) We seldom take a meal but some of the food we eat or drink is supplied by this useful animal. It gives a large quantity of milk, which is used either as it comes from the cow, in cooking, or made into butter and cheese. Its flesh is called beef (*q.v.*); its fat is made into tallow, from which candles and soap are made; its skin is tanned and made into boots, shoes, harness, and other leather articles; its hair is mixed with plaster; its hoofs are made into glue; its horns are made into combs, spoons, buttons, and the handles of knives and forks; and in some countries in Europe, Asia, Africa, and Australia, oxen are used as beasts of burden or to draw the plough. There are many different breeds, some of which are useful for dairy purposes, others yield good beef.

THE CRANE.

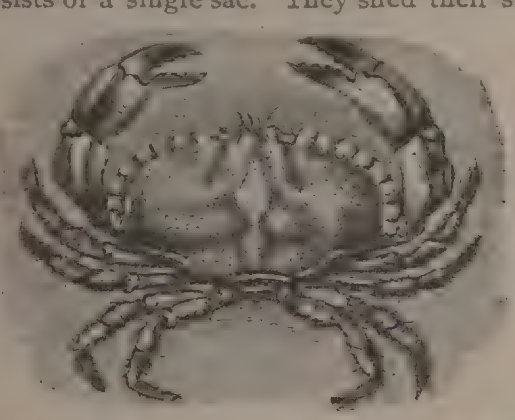
Cou'gar. A large American animal of the cat family, resembling the panther but smaller. It is often called panther (or painter). It is also called the puma, and formerly was known as the catamount, or mountain cat. It crouches in trees in the forests and springs on passing deer. In South America it kills and feeds on wild cattle.

Cow'ry. [Hind.] A small sea-shell, somewhat like a coffee berry and used as money in Siam and Africa. The shell is produced by the mollusc, and the spots on its surface are made by a coloring matter secreted by the mantle.

Cow'slip. [AS.] A kind of primrose with several flowers on one stalk appearing early in the spring.

Cow-tree. [Span.] An evergreen tree found in Venezuela, first discovered by Humboldt. The sap flows freely when the bark is wounded; and it is safe to drink freely, for the fluid, which has the color and taste of milk, is not only cool but refreshing and nutritious. It is, however, acrid and bitter. Also called the traveller's tree.

Crab. [AS.] A shell-fish with strong claws, and a tail tucked underneath its body. The eyes of crabs are on long stalks, and may be turned about or folded back into little grooves in the shell. Crabs breathe by gills, and a crab's heart consists of a single sac. They shed their shells at intervals, and while the new shell is growing is known as *soft-shell crabs*. These are esteemed as food in the United States. In the tropics some species of crabs live in the fresh water of the rivers; others in the damp forests, visiting the sea-shore to deposit their eggs; others, like the land-crabs of Jamaica, live on the mountain tops. The hermit crab is a curious animal without a shell for its soft body; so it seeks to shelter its body in some empty shell, and when it outgrows one shell hunts for a larger one, sometimes turning out the living owner of a shell it wishes. The fiddler crab has one claw much larger than the other, developed by fighting, which it holds up as it walks sideways. The females of the pea crabs, or oyster crabs, live in oyster shells, and go out and in at will. Horse-shoe crabs, or king crabs, the largest crabs, are dark brown, and have long, stiff tails.



Cran'berry. [AS.] A red berry with a sour taste, growing on a stalk like the neck of a crane. It is cultivated in Europe and the United States, the American plant bearing larger berries. It is used in tarts, and is cooked with sugar as a dessert.

Crane. [AS.] A long-legged, long necked wading-bird. Cranes are either white or brown, and are without crest plumes on their heads, except the African crowned crane, which has an upright tuft on its head. They are remarkable for their long migrations twice every year, and for their perfect discipline on these journeys. The Greeks and Romans esteemed the flesh of the crane as a delicacy.

Crane. A machine for lifting and lowering weights, and, while holding them suspended, carrying them a short distance to the side.

Crank. [O.E.] A bent portion of an axle or shaft or an arm keyed at right angles to the end of a shaft, by which motion is directed or received.

Cray′on. [Fr.] A pencil of colored chalk. A pencil of carbon used in producing electric light.

Cream. [Fr.] Cream is milk-fat, and rises above the watery particles of the milk. When cream is examined with a microscope, it is seen to be composed of very small balls of fat, each of which has a skin or covering of curd. By churning, the skin of curd is broken, and the little lumps of fat unite to form the yellow solid called *butter*. (See *Curds*)—*Cold-cream*, an ointment of white wax, almond oil, rose-water, and borax, used as a salve.

Cream of Tartar. An alkaline tartrate, known as the bitartrate of potash. As prepared from argol—a deposit from grape-juice—it is a white crystalline substance, and the crystals, when reduced to powder, form the *cream* of tartar. It dissolves readily in hot water, but sparingly in cold. It is used in medicine.

Cre′matory. Within recent times burning instead of burying dead bodies has come into use to some extent, and is growing in popularity. Crematories or furnaces for this purpose exist in several of our large cities.

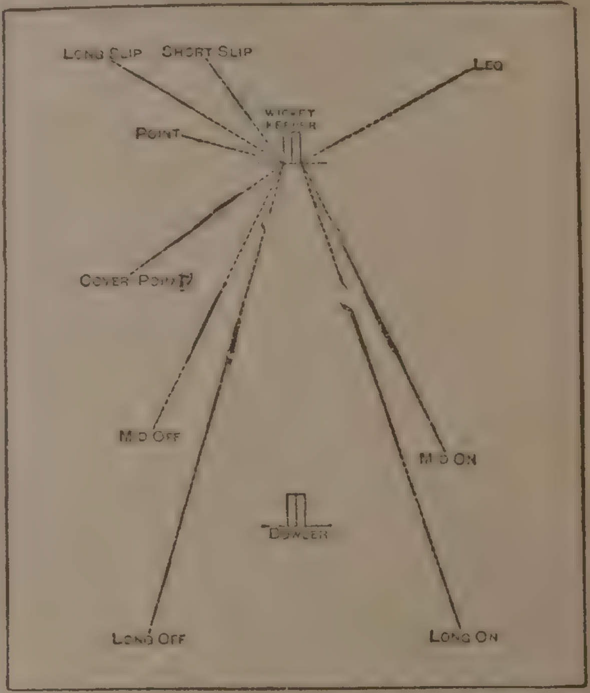
Cream′ery. A factory for the production of butter. Creameries are now widely in use in the United States, their effect being cheapness in production and a better and more uniform quality of butter than that made on the farm.

Cre′osote. One of the substances derived from the tar obtained from the distillation of wood. It differs chemically from the creosote obtained by distilling coal-tar. Wood creosote coagulates albumen, but does not coagulate collodion; which distinguishes it from carbolic acid, the leading product of coal creosote. It has great antiseptic power, hence its name (Gk. *kreas*, flesh; and *sozein*, to preserve). A piece of meat steeped in it does not putrify. Both wood and coal-tar creosote are used as preservatives for timber placed in the ground.

Cress. [AS.] A plant which grows in moist places, used as a salad. The leaves have a pungent taste, and are anti-scorbutic.

Crick′et. [Fr.] An insect with a sharp voice found under the floors of houses in Europe. Whatever is moist they seek for, and they will eat yeast, crumbs, milk, or kitchen refuse. The noise of the cricket is produced by the male. He raises his horny wing-cases and rubs them briskly together. The sound he makes is *cree-cree*, hence his name. In Africa crickets are fed in a kind of iron oven and sold to the natives, who esteem them because their noise lulls to sleep. The field-cricket feeds on herbs that grow at the mouth of its burrows, and in summer they sit there chirping all night and day.

Cricket. [AS. *crook*, a small staff.] A game played with bat and ball and wickets. It is the favorite game in England and the British Colonies. In the colleges and cities of the Eastern States it has become popular. Eleven men make a team. The man with the bat stands in front of the wicket, which is three upright stakes with two short bails or sticks resting on their top, when these are knocked off the player is out. The ball is bowled with an over-hand throw with the purpose of knocking the wicket.



Cro′chet. [Fr.] Knitting by a hooked needle with cotton, worsted, or silk.

Croc′odile. [Gk.] A large and fierce animal found in the Nile and other rivers of Africa, also in Asia and America. It grows to 16 or 18 feet in length. The mouth of the crocodile has no lips to cover its strong teeth, which are firmly set in pits in the jaw, with a new tooth started below the root of each tooth. The fourth tooth in the lower jaw is longer than the other teeth, and when the mouth is closed it reaches up over the upper jaw. The crocodile bird enters its mouth in pursuit of insects which infest its mouth. The hide of the crocodile is tough, and is composed of plates of bone covered with horny scales. Its tail is useful in swimming, and also in the capture of its prey. It strikes large animals with it, and by it holds them under the water till they drown. Its neck is wanting in flexibility, and so it has much difficulty in turning. Its eggs are laid in the sand, and hatched by the heat of the sun. Alligators are like crocodiles, but they are smaller, and their feet are not so completely webbed, and they are found only in American waters.

Cro'cus. [L.] A flower white in color in wild state; cultivated forms are yellow or purple; rising from the bulb, blossoming early in spring. One species, the saffron, blossoms in autumn.

Cross. [Fr., from L.] Two pieces of wood laid one across the other, either simple cross I, or St. Andrew's Cross x, or St. Anthony's Cross T, or the Latin Cross †.

Crow. [AS.] A genus of birds, related to the magpies, nutcrackers, jays, and other forms. The Crows have long, strong, and compressed bills, with the ridge of the mandible more or less curved, and the tip notched; the wings are usually long, the tarsi covered with broad plates, and toes of moderate length. They feed not only on grain and fruit, but on animal substances, and some species on carrion. They all make large nests of sticks, lined with soft hair or down, and lay eggs with dark spots on pale-bluish, greenish, or white ground. True crows include the raven, the carrion crow, the hooded crow, and the rook. The rook and jackdaw are gregarious, the rook nesting on trees, and the jackdaw on high buildings, such as church towers. The raven, carrion crow, and hooded crow all feed on carrion, and are fond of eggs, and young birds or rabbits. The American crow resembles the carrion crow, but is smaller, and after the breeding season gathers in large flocks. Its fondness for grain and seeds is an annoyance to the farmer, but it repays him by devouring large numbers of worms and larvæ. It is one of the most intelligent of birds. The fish crow of the United States is very expert in catching river and sea fish.

CRYSTALS.

Crown. [Fr.] An ornamental head-dress for a king or queen. Nobles wear coronets, the pope a triple crown or tiara. The crown of England is a circle of gold with crosses, fleur-de-lis, and imperial arches, enclosing a velvet cap, and set in diamonds and precious stones.

Cru'cible. A vessel or pot for the melting of glass or metals. It is made of some substance which will stand a great heat, usually clay mixed with black-lead, sand, or other refractory substance. For the use of chemists crucibles are made of platinum, silver, porcelain, blacklead.

Crui'ser. In modern navies a cruiser is a ship-of-war, armored or unarmored, designed for cruising, and lighter in armament than the battleship, while higher in speed.

Crys'tals. [Gk.] The term applied in chemistry and mineralogy to those bodies which have assumed a regular geometrical form, in contradistinction to those substances which are amorphous. Although there are numerous varieties of crystalline form, they can all be reduced to six primary systems. These are distinguished from each other by the number and position of the *axes*, which are mathematical straight lines assumed to intersect each other in the centre of the crystal, and to connect the opposite faces of the crystal or its opposite corners. Each substance which crystallizes possesses a definite form, serving as one of the marks to distinguish it from other substances.

Cuck'oo. [O.E.] A climbing and perching bird, about twice the size of a lark, which feeds on caterpillars, grubs, and insects. The cuckoo does not build a nest, but places her eggs in the nests of other birds. Sometimes the birds turn the strange egg out, but oftener the mother bird takes it under her care and hatches it with her own. Though the cuckoo egg is small, the young cuckoo is larger than those young birds in the same nest, and turns all the other young birds out, and often kills them. The tree-cuckoos of America also have this peculiarity. The cuckoo is called "the harbinger of spring," because it comes over the sea when winter is gone, and its cry of "Cuckoo! cuckoo!" seems to say that spring is come. The Arabs think the bird says "Yakub!" hence they call it Yakub's (or Jacob's) bird.

Cu'cumber. [L.] A creeping plant, with fruit of a long and usually curved shape, used for salads, either fresh or pickled.

Curaçoa'. A liqueur or cordial, flavored with orange-peel, cinnamon, and mace; first made at the island of Curaçoa, in the Dutch West Indies.

Curds. [Celt.] The thickened part of milk. If a weak acid be added to milk, solid whitish lumps of *curd* separate from a watery liquid called *whey*. If, instead of a weak acid, an acid fluid obtained by soaking the stomach of a young calf in salt water, which is called *rennet*, is used, it quickly and completely coagulates the curd and separates it from the whey. When curds are analyzed, they are found to be composed of a substance known as *casein*, which contains nitrogen, and is classed with the nitrogenous or flesh-forming food-stuffs.

Cur'lew. [Fr.] A sea-bird which neither swims nor dives, and leaves the shore in summer for the inland country, where it nests and rears its young. In the autumn and winter months flocks of curlews may be seen at the sea-shore feeding on small crabs, shrimps, and worms. The curlew is about two feet in length, and when its wings are spread out they measure three feet from tip to tip. It makes its nest on the ground among dry grass, and lays in it four greenish eggs spotted with brown. It is easily tamed, and is common in Europe, North America, and some parts of Asia.

Cur'rant. [Fr., from Gk. *korinthos*.] A small seedless raisin from Corinth; the fruit of several shrubs, as common red-currant, white currant, and black currant, used for jams or jellies; also the flowering currant, with showy white, red, or yellow flowers.

Cur′rent, Electric. A quantity of electrical force conveyed along a wire, from an electric machine, a galvanic battery, or a dynamo, and employed for producing sparks, operating motors, etc.

Cut′lery. All kinds of table, hunting, butchers' and cooks' knives and forks; razors, pocket-knives, scissors, and shears. Also surgical, dissecting and dental instruments are sometimes included.

Cut′tle-fish. A form of mollusc, without an external shell, somewhat like the octopus, but with two tentacles longer than the arms and with club-shaped ends and curious suckers. There are also narrow fins at the sides of the body; and the mantle is supported on the inside by a thin plate, which is known as cuttle-fish bone. These are used in bird-cages. They are not like true bone, but are formed of layers like shells, with a hard covering, and the birds peck small particles of lime from them.

Cy′clone. [Gk.] A great storm moving in a circle or spiral, which may be less than 100 or more than 2,000 miles in diameter. It is attended with violent winds and heavy rains, and sometimes does immense damage. The storm moves slowly or rapidly forward. The *Anti-cyclone* is opposite to the cyclone, its winds blowing out from instead of towards a centre.

Cyl′inder. [Gk.] A long, round body, the ends of which are equal circles opposite to each other.

Cym′bal. [Gk.] A musical instrument formed of two metal plates, which are clashed together.

Cy′press. [L.] An evergreen tree, often planted in grave-yards. Its wood is remarkable for great durability, and yields a healing balsam.

D

Dace. A small fish of the Carp family, found in clear and quiet streams in Europe. It makes good sport for the angler, and its flesh is preferred to that of the roach, but is not highly esteemed.

Da′do. [Ital. a cube.] The solid part of the pedestal of a statue; the lower part of the wall of a room when ornamented with mouldings or differently from the rest.

Daf′fodil. [Fr.] A kind of lily or narcissus, with a bulbous root and beautiful flowers, usually yellow; called *daffadowndilly*.

Daguerre′otype. The predecessor of the photograph; the method of printing pictures of natural objects discovered by Louis Daguerre, and made known in 1839. The images were impressed on a silver plate, made very sensitive to light by a coating of iodide and bromide of silver. The daguerreotypes were not very permanent, and have been replaced by photographs. (See *Photography*.)

Dah′lia. [Swed. *A. Dahl*, a botanist.] A tuberous plant, with a large and beautiful single or double flower. It is a native of Mexico and Central America; but the cultivated varieties are numerous—more than two thousand—with bright and varied colors. The first roots were carried to Europe by Humboldt in 1790.

Dai′ry. [Scand.] A place for keeping milk and making butter and cheese. A dairy should be lofty, well built, and roofed with slate, the windows covered with gauze wire, the floors and walls overlaid with smooth, polished tiles, and the shelves of slate or marble. It should be cool, dry, clean, and well ventilated, and furnished with pails, coolers, sieves, bowls (either of earthenware or glass), dishes for skimming milk, plunge or barrel churns for making butter, slices, scales, and weights. A system of dairy factories or associated dairies was instituted in the United States in 1860, and has developed so greatly that there are now more than 1000 in the State of New York alone, and the system has been introduced into several countries of Europe. They were at first confined to cheese-making, but many of them now make butter and cheese, and there are numerous creameries (*q.v.*), making butter only.

Dai′sy. [AS., day's eye.] A small wild flower, with a white rim of petals arranged like a star, and a yellow centre. The flower is held in a green cup, on a short, wiry stalk rising from thick green leaves. It grows in fields or by the wayside, and is found low down in the grass. It blooms from early spring to late in autumn, opens when the sun shines and closes at night. *Ox-eye daisy*, or the Daisy of North America, is also called the whiteweed. It is a kind of *chrysanthemum*.

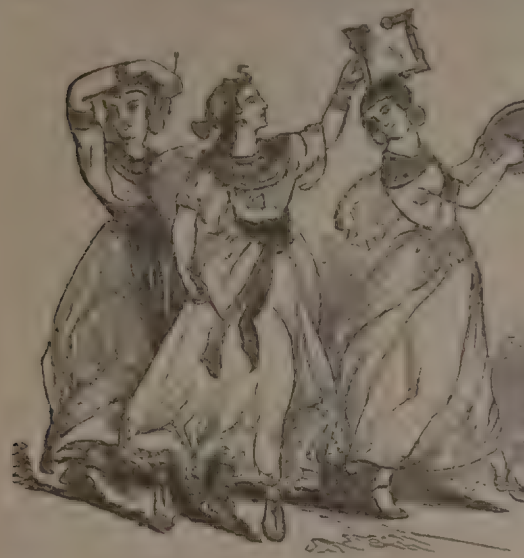
Dam′ask. [Damascus.] Cloth of silk, linen, or wool, with figures woven on it by different directions of thread without change of color, first made at Damascus. Damask is woven with a twill, in which the weft threads skip eight of the warp. In diaper cloth the weft skips five instead of eight.

Dancers, Eastern. Young women of the Eastern countries noted in the dance for their graceful and rhythmic movements.

Dan′delion. [L. *dens leonis*, a lions tooth.] An herb common in Europe and the United States, with large yellow compound flowers, and leaves with jagged or notched edges. The root is mixed with coffee, and is a useful tonic, and the young leaves are used as a salad.

Darwin′ian Theory. The theory of *natural selection*, advanced in 1859 by Charles Darwin, which maintains that all species of animals and plants are derived from older species by a process of survival of the individuals best adapted to the surrounding conditions of nature, and hereditary transmission of their superior structure.

Date. [Fr.] The date palm-tree and its fruit. The fruit is shaped like an olive, is sweet and wholesome, and has a hard kernel. It is the chief article of food of the natives of Arabia and North Africa, and is their principal source of wealth. The tree rises to a height of 60 feet, with a crown of large feathery leaves and flower-stalks, and white flowers that are followed by the fruit in bunches. The leaves are used as thatch, the sap by fermentation is made into wine, and the wood is useful for furniture and in building.


EASTERN DANCERS.

Da′vit. [Fr.] A piece of timber used for keeping the anchor clear of the ship's side when being hoisted; *pl.*, arms of iron over a ship's side or stern from which a boat is hung, ready to be let down or to be raised.

Day. [AS.] A word originally used to indicate the period of time during which it was light, in contrast to night or the period of darkness. This usage still exists, but a day in its civil or legal sense, is now the period between midnight and the succeeding midnight, or 24 hours. The siderial day, which is based on a seeming revolution of the stars, instead of the sun, is shorter, being 23 hrs. 56 min. 49 sec. Astronomers reckon the day as beginning at noon, and count the hours from 1 to 24.

Dea′con. A person in the lowest degree of holy orders. In the Roman Catholic Church the deacon acts as an assistant to the priest, and may preach and baptize with the permission of the bishop. In the Church of England he can exercise nearly all priestly functions. In the Presbyterian, Baptist and other Churches the deacon or elder is an officer selected to assist the minister in the direction of religious affairs.

Decant′er. [Fr.] A large glass or bottle for holding liquor free from sediment, from which drinking glasses are filled.

Deck. [Du.] The upper floor or covering of a ship. The name, however, in a large vessel is applied to the berth-deck, where the sailors' hammocks are hung; the gun-deck; half-deck, the part below the spar-deck; hurricane-deck; orlop-deck, where the cables are stowed; poop-deck, with a cabin; quarter-deck, including poop-deck; spar-deck, or upper deck.

Deep Sea Explora′tion. Dredging the ocean depths to discover the conditions there existing. Many expeditions have been sent out for this purpose, the most interesting discovery being the fact that numerous animals, of peculiar forms, inhabit the ocean at great depths, numbers of them being brilliantly phosphorescent, and thus lighting up their dark abode.

Deer. [AS.] A family of ruminating animals, with slender limbs, and large antlers or horns on the head of the male animal. These are solid, and are shed annually in the spring; but new ones grow rapidly and send out branches, so that in a few months the deer has another pair of horns, each year's antlers increasing in size till the seventh year, after which they get smaller. The deer feed on vegetable substances, and they are wont to swallow large quantities without much chewing, and masticate at their leisure; this they can do because they have a complicated stomach divided into four chambers. (See *Digestion.*) The reindeer is found in the north of Europe and America. It is used for drawing sleds; and its flesh and milk supply the natives with food, and its skin with covering. It eats moss and lichen. The horns of the wapiti, or Canadian red deer, weigh more than 60 pounds. The moose, or elk, is the giant of the Deer tribe. The fallow deer has palmated horns. The musk deer is about 20 inches in height. The musk, from which it is named, is secreted in the abdomen.—*Deer-stalking*, hunting the stag by stealing on it unawares.

Degree′. [Fr.] The 360th part of a circle; 60 geographical miles; the unit of measure for arcs and angles; divided into 60 minutes, and each of these into 60 seconds; also a distinction conferred on graduates of a college or university.

Honorary degrees are conferred on persons of distinction without examination as to their attainments.

Delf. A kind of earthenware made at Delft, in Holland; also any glazed earthenware for table use made in imitation of that.

Denuda′tion. The removal of solid matter by the flow of water in streams, or the action of the waves and currents of the seas. The process is continuous in regions of plentiful rainfall, the surface layers of the earth being gradually carried away to deposit in bays and seas.

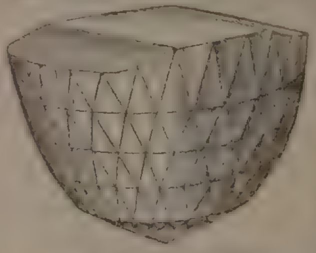
Dev′il-fish or **Oc′topus.** A highly organized mollusc without an external shell, and sometimes of great size. Its head has large staring eyes, and its eight arms or feet have two rows of suckers, which adhere to animals or objects by a curious mouth with two long teeth. Within its body is a sac with an inky fluid, which it throws from a funnel in its mouth when alarmed. This ink is used as sepia, or India ink. The name *devil-fish* is sometimes applied to the *fishing-frog*, and in America to a gigantic species of *ray*, one of which has been found in Delaware Bay weighing 5 tons.

Dew. [AS.] The name given to the drops of water which are seen on the leaves of plants on bright mornings, more especially in the spring and autumn. The air contains aqueous vapor, and the amount of vapor which the air will carry increases as the temperature of the air rises, and diminishes as it falls. When the air contains as much vapor as it is capable of taking up at any particular temperature, it is said to be *saturated;* and when it is cooled below the point of saturation, condensation takes place, and the moisture deposited in this way from the atmosphere is termed *dew*. The temperature at which dew begins to be deposited is termed the *dew-point*. When the sky is clouded, the greater part of the heat radiated by the earth is reflected back from the clouds, and the temperature of the air does not sink to the dew-point. It will be found that on cloudy nights there is no deposition of dew. The air should be still, otherwise no air remains long enough in contact with the ground to be cooled to the dew-point.

Dew′berry. An American species of blackberry, with prostrate stems, abundant in dry, stony fields from Canada to Virginia. Its fruit is of large size and delicious taste, being much superior to the high blackberry. There is a British fruit of the same name, but not nearly so palatable.

Di′al. [L. *dies*, a day.] An instrument constructed to show the hour of the day from the position of the shadow of a style cast by the sun on the face of a dial-plate. It consists of a straight rod or style attached to a plane surface, which is graduated in such a way that the shadow points to the correct time of day as shown by the sun. The style is placed in a direction parallel to the earth's axis. The time shown by a sun-dial is true solar time.

Di′amond. [Fr., from Gk. *adamantos.*] The hardest and next to the ruby the most valuable of gems. Chemically, it is pure, crystallized carbon, its crystalline form belonging to the regular or cubic system, having generally eight or twelve faces. The best diamonds are perfectly clear and colorless, and are described as being of the *first water*. The peculiar lustre of the diamond distinguishes it from all other substances, and the vivid brightness and intense glow of its reflections are unsurpassed by any other stone. It is also distinguished from other gems by its extreme hardness. The value of a diamond is greatly enhanced by cutting. This industry was at one time confined almost exclusively to Amsterdam, but it is now carried on in other places. Diamonds are cut in two forms—the *brilliant* and the *rose* cut. The former brings out better the beauty of the stone. The dust is used by the lapidary and the gem-engraver, and the stone is used for jewelling watches and in cutting glass, and for the latter purpose it must not be cut. Inferior sorts are used by engineers in rock-boring, and by copper-plate engravers as etching-points. Diamonds are found in India and Borneo, and sometimes in North America and Australia; but the chief diamond fields of the present day are those of South Africa and Brazil. They were first discovered in South Africa in 1867, existing there in a blueish earth, from which they are washed out. An immense number of diamonds, of great collective value, have been obtained from these mines. Among the large diamonds found the most famous is the Koh-i-noor, which has a very interesting history. Others are the Great Mogul, the Orloff, the Regent, and the Sancy.



THE ORLOFF DIAMOND.

Di′aper. [Fr., corrupted from Gk. *iaspis*, jasper.] Linen or cotton cloth or towelling, woven with constantly-repeated figures like jasper. (See *Damask.*)

Di′aphragm. [Gk.] A muscle crossing the body, separating the chest from the abdomen, and forming a movable partition between these two cavities, its most important office being connected with the function of respiration.

Di′atoms. The name of a family of minute plants, inhabiting seas and rivers, each consisting of a single organic cell, inclosed in a double case of silica, the two halves fitting together like a box and its lid. They exist in vast multitudes and of many different forms, being visible only under the microscope.

Die. [F.] A stamp, often one of a pair, used in marking coins, in forging metals, and in striking sheet metal. Dies are always made of the finest steel, and the figures on the die are cut by small steel tools. Book-stamps are cut in brass instead of steel.

Digest′ion. [L.] The power of dissolving and distributing food over the body. All vertebrates have a mouth, which is generally furnished with teeth. The food is mostly cut and divided in the mouth and mixed with saliva, after which it is swallowed and digested in the stomach (*q.v.*) by gastric juice, and in the intestines by bile and pancreatic juice, the nutritious portions being absorbed in the blood. In shell-fish, after food is crushed by hard plates in the stomach and mixed with saliva, it passes into a long intestine, where the nutritious parts are absorbed into the blood. Insects pass the food into a crop and then into a gizzard, where it is crushed and passed into the true stomach and intestines.

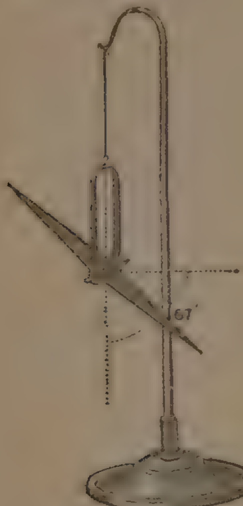
Digita′lis. A genus of plants of which the best known species is the common foxglove, which bears handsome flowers—large, rosy, spotted within with white and purple, and hanging gracefully. The leaves have an acrid, bitter taste, and an overdose of them is poisonous. Employed in small doses, digitalis is a useful medicine, being very useful in diseases of the heart, and in inflammation.

Dike. [AS.] Earth dug out and raised up in a bank; also a wall of turf or stone. In geology, a volcanic rock filling up fissures in the strata.

Dim′ity. [L.] A cotton cloth used for curtains. It is plain or twilled, sometimes in colors.

Diphthe′ria. A very malignant disease of the throat, mainly attacking children, and often fatal. It is a contagious disease, due to the presence of noxious bacteria, and has been successfully treated by inoculation with an antitoxin, or serum, produced by culture of diphtheria germs.

Dip′ping-nee′dle. An instrument for measuring the dip or inclination of the *compass* needle to the horizon, and from this fact it is also termed the *inclination compass.* It consists of a magnetic needle very accurately mounted on a horizontal axis.

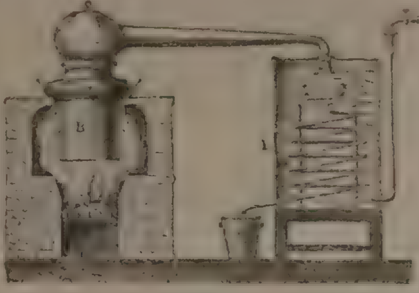


DIPPING NEEDLE.

Disc or **Disk.** [AS., from Gk.] The round surface of a plate or star. In owls, the space around the eyes. A disc engine is a kind of rotary engine.

Disinfect′ant. An agent for destroying the germs of infectious diseases, or for removing by oxidation the organic matter in which germs develop. Some of the substances used for this purpose are sulphurous acid, obtained by burning sulphur, corrosive sublimate (mercuric chloride), chloride of lime, carbolic acid, Condy's fluid, and green vitriol (ferrous sulphate).

Distilla′tion. This process consists in boiling a liquid and condensing the vapor which is formed. The liquid, which we may suppose to be water, is heated in a vessel. The steam or vapor, as soon as it is formed, is made to pass through a coil of pipes, placed in a vessel of cold water. While passing through this coil, the vapor parts with its heat to the cold water, and on condensing is drawn from the end of the worm. The vessel must be constantly replenished with cold water, and the heated water allowed to run off, otherwise the condensation would soon cease. The object of distillation is generally to free the liquid from any impurities it may contain, and also to separate a more volatile liquid from one less so, such as alcohol from water.



Div′ing-bell. An apparatus in which persons may be let down and remain for a considerable time under water without much inconvenience or danger. It is a large vessel, closed at the top and sides, but open at the bottom. It takes its name from having been originally shaped somewhat like a bell; but it is now generally made square at the top and bottom, the bottom being somewhat larger than the top. The bell is used in blasting rocks under water, in examining the foundations of piers and bridges, and in recovering stores and treasures from sunken vessels. A code of signals has been arranged by which those below can make known their wishes to others stationed at the top. Dresses have now been devised which enable divers to work under water without the aid of a diving-bell. The dress is made of india-rubber cloth, and covers the entire body. The head is covered by a helmet provided with eye-holes covered with strong glass. Air is supplied through a tube which enters the head-piece, and is connected with an air-pump above. A dress of this kind is now much used by those who dive for pearls, sponges, and coral.

Dock. [Du.] An artificial place with gates, for ships being loaded or unloaded. The *dockyard* is the place near the dock where stores for ships are kept. A *dry dock* is one from which the water has been pumped out, and is fitted with appliances for making or repairing ships, and includes graving-dock, floating-dock, and hydraulic dock. A *wet dock* is the name for a dock with water shut in at a fixed level, and opened or shut according to the state of the tide.

Dog. [O.E.] The dog is a carnivorous quadruped, and belongs to the same family as the fox, the wolf, and the jackal. It has long been domesticated, and is the faithful companion of man, having followed him into every part of the world. There are many varieties, which are carefully bred. They include the large and useful Eskimo, Newfoundland, and St. Bernard breeds; the various long and slender hounds, the pointer, setter, and other hunting dogs; the alert little terrier; the water-loving spaniel; the watchful mastiff; the fine and powerful bull-dog; the highly intelligent collie or sheep-dog, and various others.

Dog′fish. A small shark of many kinds. The European spotted dogfish is abundant; the American dogfish is sometimes called the blue dogfish; the common dogfish, both in America and Europe, is horned.

Dog′star. Sirius, the brightest of the fixed stars in the Canis Major or Greater Dog constellation. The conjunction of the rising of the dogstar with the rising of the sun was thought by the ancients to be the cause of the great heat of summer and the consequent sickness, and the period of six weeks from the middle of July was hence named *dog-days*.

Dog′wood. The American dogwood is a small but very ornamental tree, bearing flowers surrounded with large white bracts, and scarlet berries in winter. The bark is a useful febrifuge. The European dogwood is a shrub whose foliage becomes deep-red in autumn. Its wood is very hard, and is used for skewers, cogs for wheels, etc., and also makes the best charcoal for gunpowder.

Dol′lar. [Sax.] A silver coin of different value in different countries. In the United States the silver dollar weighs 412½ grains. The name is an abbreviation of Joachim's thaler, first coined in 1518 in St. Joachim's Valley, Bohemia.

Dol′phin. [Fr.] A mammal smaller than the true whale, and common in all seas. It is more elegant than the porpoise, and is distinguished by its long snout. Dolphins follow vessels in companies, leaping out of the water and tumbling about. They chase flying-fish relentlessly, and prey on small fish, and often follow them into shallow waters or up rivers. In color the dolphin is black above and white below, but it is said to change its color when dying. Its head is peculiarly shaped—round above and long like a beak.

Dom′ino. [Ital.] A kind of hood worn by the canons of a cathedral; a mask. Also a small piece of wood, bone, or ivory marked by from one to six dots, or blank, for playing the game of dominoes. The game is played by matching the dots.

Dor′mouse. A small rodent animal that sleeps in winter. It lays up a winter store of nuts, and does not bury them, but prefers to hide them in the tree, which serves for a home. It weaves a nest of grass blades, like that of the harvest mouse.

Dove. [AS.] A bird of the genus *Columba*. It is the same as the pigeon, there being no distinction in the terms. The European turtle-dove has a sweet plaintive note; the ring-dove is the largest; the sea-dove is the little auk.

Dove′tail. [O.E.] The ends of two boards fitted into each other by one being cut the shape of a dove's tail. The one is called a tenon, and the other the mortise or socket.

Drag′on. [Fr., from Gk., a serpent.] A fabulous winged serpent; a small tree-lizard or flying-lizard of several kinds found in the East Indies and Southern Asia. Five or six of the hind ribs on each side are prolonged and covered with a web-like skin, forming a kind of wing. This wing aids it in flying or leaping from tree to tree.

Drag′on-fly. An insect with a large head and great eyes, and a white, scarlet, blue, and green long sharp body, and four strong gossamer-like wings. It preys on flies, gnats, mosquitoes, and butterflies. It lives mostly about water, and lays its eggs in the water, in which the larvæ are hatched. The pupas are not inactive, as in many insects, but are voracious insect-eaters.

Dragoon′. [Span.] A soldier who used to fight either on foot or horseback, with a musket carved with dragons; a horse-soldier with a helmet.

Drain. [AS.] An arrangement of channels for draining off water from houses or fields. House-drains are glazed and water-tight.

Drainage-tubes. A recent appliance used in surgery. The tubes are of india-rubber, perforated with numerous holes, and are introduced into chronic abscesses and large wounds to draw off the pus as formed. In some cases tubes of glass, or of decalcified bones are employed.

Draughts. A game for two persons, each with twelve round pieces of different colors, played on a board marked with black and white squares.

Dredge. [Fr., from Du.] A scoop for bringing up mud from the bottom so as to deepen rivers or docks; also a drag-net to sweep the bottom of streams or seas for other purposes.

Drill. [Du.] An instrument for boring, usually with an edged or pointed end, and cutting by revolving. Diamond drill is a rod set with diamonds for boring rock.

Drom′edary. [Low L.] The African or Arabian camel, which has but one hump. (See *Camel*.)

Dross. [AS.] The impure portion or dregs which sinks to the bottom, or the scum which rises to the top, especially from metals when ore is smelted.

Drug. [Fr., or from *dry.*] Something dried to make a medicine. Applied to medicinal agents used in the treatment of disease, or more generally the crude substances which, after they have undergone preparation, are usually called medicines. To be *drugged* is more particularly applied to those suffering from a narcotic medicine, which produces stupor, and sometimes death.

Drug′get. [Fr.] A coarse cloth dyed of one color, made of wool, to protect carpets.

Drum. [O.E.] A large tube with tight skins over the ends, beaten to accompany music—a kettle-drum has a metallic hemisphere, and a single piece of skin to be beaten; the tympanum or stretched membrane in the inside of the ear; a broad wheel on a revolving shaft, round which a belt is put to drive another wheel.

Dry′ing Machines. Machines for the rapid drying of fabrics or other materials by centrifugal force. They revolve so rapidly that the water is thrown off from the enclosed substance. The centrifugal process is also used as the final stage in sugar production, the sugar being placed in a perforated cage, and the machine whirled round at a speed of 1,000 rotations a minute. This throws off the molasses, and leaves the sugar crystals nearly white. In paper-making machines are fans which drive heated air against the inner surface of the paper, rapidly drying it.

Duck. [O.E.] A well-known swimming-bird, whose boat-shaped body and long neck and webbed feet adapt it to live in the water. Its body is covered with a thick and close plumage; its coat of down is very thick; and it has a large supply of oil in an oil-gland which keeps its feathers from getting wet. Its flat bill is supplied with rough plates around the edge, which form a good strainer, and so it can pick its food from the mud and water it takes into its mouth. Ducks are kept on farms for the sake of their eggs and their flesh. The feathers are also of use for bedding, those of the eider duck (*q. v.*) being especially soft and fine. River ducks include the common domestic duck, the wood-duck, the mandarin or Chinese duck, and the Muscovy duck, originally of South America. The steamer-duck of South America cannot fly, but swims swiftly.

Dye′ing. [AS.] A process consisting in fixing the color in cloth and other materials by immersing them in a prepared bath containing coloring substances. Dyes are obtained from animals, vegetables, and minerals, the different tints being secured by combining the requisite number of simple coloring substances with one another. In order to render the colors permanent, mordants are used. These consist chiefly of the salts of iron, alumina, and tin. With aniline and some other dyes no mordant is required. Indigo is the chief of blue dye-stuffs; quercitron and fustic dye yellow; and madder, log-wood, cochineal, and aniline dyes are the most common red dyes.

Dynamite [Gk. *dynamis*], or **Giant Powder.** The general name for various explosives, prepared by mixing nitro-glycerine with some absorbing substance which prevents leakage. The materials used for this purpose are sawdust, silicious marl, rotten-stone, tripoli, the meal of Indian corn, sponge plaster, and an infusorial earth known as "keiselguhr." Its explosive powers are very great, while it is far safer to handle than nitro-glycerine. It was discovered in 1867 by Alfred Nobel, a Swedish chemist.

Dynamo. [Gk.] A machine used for generating a current of electricity by the rotation of coils of wire with iron cores between the poles of a powerful electro-magnet. When any conductor of electricity is moved about in the space surrounding the poles of a magnet so as to cut the lines of force at right angles, currents of electricity are produced in the conductor. In magneto-electric machines permanent magnets are used; but when an electro-magnet is substituted for the permanent magnet, the machines are termed "dynamos," or dynamo-electric machines. Dynamos are used for electric lighting; also to operate electric motors on cars and in factories to drive machinery—the motor being simply a reversed dynamo.

E

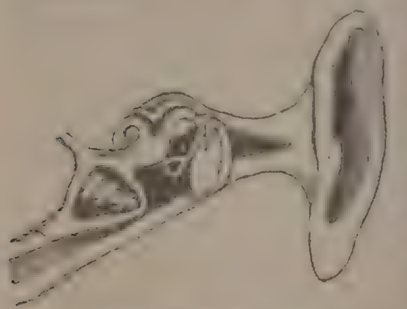
Ea′gle. [Fr., from L. *aquila.*] A large vertebrate bird of prey of the Falcon family, with a short, sharp, hooked beak; short, strong feet; very strong, sharp, hooked claws (*q.v.*); and a long tail. It has keen vision, is solitary in its habits, and builds its nest usually on the top of a lofty tree in a swamp, or on some rocky peak, of large sticks and branches heaped together. It uses the same nest year after year. It feeds on birds, squirrels, hares and rabbits, and lambs from the flock, seizing its prey, not with the beak, but with the talons (*q.v.*), sometimes driving its breast-bone straight against what it wishes to kill. The most noted species are the golden eagle, the imperial eagle, the American white or bald eagle, and the European sea-eagle. The golden eagle is a fine large bird. Its nest is roughly made up, and often measures five feet square. The young eagles never number more than four, and are hatched in thirty days. This bird, on perceiving its game, circles in the air, and then slowly descends in decreasing circles till the prey is caught. The bald or white eagle is about the size of a small hen turkey. Its head is not really bald, but covered with thick, white feathers, which give it this appearance. Its feathers are of a brownish-black color. It loves fish, but does not catch them itself. Instead, it watches the fish-hawk or osprey at its work, and when it sees that the hawk has caught a fish, it swoops downward and forces it to yield its prey.

The eagle was the emblem of ancient Rome, and is now the emblem of the Austrian and Russian empires, and of the United States. The

Austrian and Russian eagles are made with two heads, in imitation of the double-headed eagle first used by Constantine the Great, one of the heads of which meant the Western Empire, and the other the Eastern Empire.

Eagle, a gold coin of the United States, whose value is ten dollars. It was first coined in 1795. The half eagle was first made in the same year, the quarter eagle in 1796, and the double eagle in 1849. These coins are not pure gold. The eagle was named from the emblem of the United States.

Ear. [AS.] The mechanism through which sound reaches the brain. In man and the higher vertebrates the ear is divided into three parts—the outer opening, or meatus; the middle ear, or tympanum or drum; the inner ear, or labyrinth. The membranous labyrinth consists of a number of sacs and tubes containing a lymph fluid, which fills a cavity known as the bony labyrinth. The sound collected by the outer ear sets the tympanic membrane vibrating; the bones in the middle ear convey these vibrations to the inner ear, where the fibres of the auditory nerve receive them and send them to the brain. A passage called the eustachian tube opens from the inner cavity into the throat. When through cold the throat is swollen, the mouth of this tube may close and deafness ensue. The ears of animals of prey bend forward to collect the sounds in the direction of the pursuit. The ears of animals of flight, as hares and deer, turn backward to catch the sounds that may warn them of approaching danger.



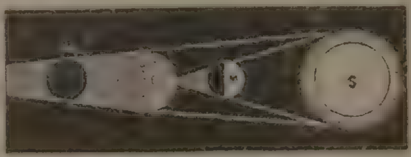
Earth. [AS.] One of the planets of the solar system, coming next to Mercury and Venus in the order of distance from the sun. The principal motions of the earth are (1) its daily revolution on its axis; (2) its yearly revolution in its orbit round the sun. It was long believed that the earth stood still and the sun, planets, and stars revolved around it, but astronomers have proved that the earth moves round the sun, completing one revolution in about 365 days 6 hours. The orbit is an ellipse, with the sun in one focus, so that the earth is not at the same distance from the sun at all periods of the year; the mean distance is about 92,800,000 miles. The motion of the earth in its orbit explains the apparent motion of the sun in the heavens during the course of the year. Many general considerations suggest to us the globular form of the earth. When a ship is sailing away from the land, the hull will be seen to disappear while the masts are still visible, and by degrees the masts also sink below the horizon. If the sea were flat, the body of the vessel would be visible as long as the masts. Mariners also have sailed round the earth, always steering in the same general direction. Measurements made at different parts of the earth's surface show that the length of a degree increases towards the poles, and that consequently the earth is not a perfect sphere, but is flattened at the poles. Its mean diameter is 7,918 miles, and circumference 24,875 miles, while it moves around the sun at a speed of 15 miles per second. The mass of the earth is rather more than five times as great as that of a globe of water of the same size would be. It has been found that the temperature increases about 1° F. for every 64 feet of descent. If the temperature were to increase at this rate inwards, then at no great depth the heat would be sufficient to melt the ordinary materials of the crust known to us. Hot springs and volcanoes show that the interior of the earth is much warmer than the exterior. It is therefore supposed that, though the materials in the interior are at an exceedingly high temperature, yet owing to the great pressure under which they exist they are most probably in the solid state.

Earth′quake. A movement or shaking of some part of the surface of the earth, resulting from a shock inflicted on a solid portion of the earth at some point below the surface. Earthquakes occur with most frequency in volcanic regions. A few of the more remarkable earthquakes of modern times were those of Lisbon in 1755, Lima in 1746, Peru and Ecuador in 1868, and the Riviera in 1887.

Eb′ony. [Fr., from Heb.] A kind of wood, usually black, hard, and heavy, which can take on a fine polish. The finest is the heart wood of a tree found in Mauritius. Other trees in Ceylon and the East Indies also yield ebony. A leguminous tree in the West Indies yields green ebony. It is used for ornamental cabinet work, mosaic, flutes, knife handles, pianoforte keys, etc. Most of the furniture called ebony is made of cherry-wood dyed black.

Eccen′tric. [Fr., from Gk.] A wheel or revolving disk, whose axis of motion is not in its centre. By its use circular motion can be converted into intermittent motion. Eccentrics are used to work the valve-gear of steam engines and for many other purposes.

Ech′o. [Gk.] A sound reflected back to the ear. It is caused by the sending back from a reflecting surface of the undulations which produce the sound. The most remarkable echoes are one at Lurlei on the Rhine; those at the Whispering Galleries at St. Paul's, London, the Observatory, Paris, and the Capitol, Washington, and those on some of the lochs in Scotland. (See *Focus.*)



ECLIPSE OF THE SUN.

Eclip′ses. [Gk. *ekleipsis*, a failing.] When a body which does not allow light to pass through it (an opaque body) is exposed to the light of the sun or of any other luminous body it casts a shadow behind. *An eclipse of the moon* is caused by the moon entering the shadow of the earth; which can only happen at the time of full moon, when the earth lies directly between the sun and moon. *An eclipse of the sun* takes place when the moon, coming between the earth and the sun, intercepts the sun's light. This can only happen at the time of new moon, when the moon comes directly between the sun and the earth. Usually the moon hides the whole disc of the sun, producing a *total eclipse*; but occasionally a thin band of sunlight is visible round the edge of the moon, and then we have what is known as an *annular eclipse* (*annulus*, a ring). This is because the moon is not always at the same distance from the earth when the eclipse happens, and at its greatest distance the apparent size of the moon is less than that of the sun. If the moon is a little out of the central line between the earth and sun a *partial eclipse* is produced.

Eel. [AS.] A kind of fish with a strong smooth skin, a vast quantity of small scales, and a long thin body. Though it has the head of a fish it has no gill covers, but only a small hole. Its dorsal and anal fins run along nearly one-third of the body, but some species are nearly destitute of fins and have no scales. Eels mostly abound in waters which communicate with the sea and some species live only in sea-waters. The fresh-water eel can creep over the ground like snakes, and sometimes passes the winter in a torpid state in mud. It has transparent horny coverings to defend its eyes from mud and stones. Eels are the terror of most other fish, and attack their prey by day and by night. The murry eel abounds in the Mediterranean and other warm seas, and the Romans esteemed it a delicacy. Eels are caught by eel-bucks, eel-sets or nets, and bobs or worms and worsted. *Electric eels* are found at the mouth of the Orinoco in pools after a flood, where they are harpooned by the natives, who drive wild horses into the water to receive their electric shocks. These eels are large, yellow, and livid, and arch their bodies, straightening themselves with a jerk, and curving back again when they produce the shock. The shock is severe enough to knock down men or animals. The electricity is generated by cells in the lower part of the body, and the number of cells varies according to the size of the fish.

Egg. [AS.] A roundish or oval-shaped body laid by birds and other animals, and from which their young come forth. The egg of the bird consists of a yolk with a germ-cell, which is surrounded by white albumen and enclosed in a shell. The germ-cell occupies little space, but it is of great importance, since from it the bird develops. Twisted cords of albumen allow the yolk to roll over when the egg is turned, but the germ-cell always keeps uppermost, and so is always nearest the body of the bird as she sits on her eggs, and thus receives the most heat. In growth the albumen furnishes the matter for the body of the young bird, and the yolk affords its nourishment. The bigger the yolk the larger will be the young chicken. There is at the top of the egg a little bubble of air for the use of the young bird, and fresh supplies of air pass through numerous small pores in the shell. The young bird, when sufficiently grown, chips the shell by a little knob on its beak; which disappears after it has come forth from the shell. An ostrich egg will weigh three pounds, and contain as much as one dozen hens' eggs. Ostrich eggs are left in the sun to hatch. Alligators place theirs under a mass of vegetable matter heaped up on purpose to produce the heat necessary for hatching. Turtles lay from 100 to 200 eggs, and cover them with sand, carefully smoothing the place where they are left to hatch in the heat of the sun. The female shark lays but two eggs, which are enclosed in leathery purse-shaped cases, with the four corners lengthened into tendrils, and these becoming entangled in sea-weed hold the egg in its place. The empty black cases of sharks' eggs are often found on the sea-shore. The eggs of fishes are tiny, covered with a thin skin, and so transparent that the fish can be seen moving inside for a day or two before being hatched. A single cod-roe will contain 9,000,000 eggs, but great myriads of fish are devoured when young by their larger neighbors. The eggs of frogs are scattered through a lump of thick jelly, which sticks to grass or twigs, and so is prevented from drifting away by that which affords food to the young animals. Many snakes lay eggs, which like those of the frog are stuck together by a thin jelly. Snails deposit tiny white eggs, which contain perfect little snail-shells within. The eggs of ants are scarcely visible. The queen ant lays all the eggs, which are immediately taken in charge by nurses that lick and clean them till little white grubs are hatched. The queen bee lays all the eggs of bees, sometimes 2,000 in a single day, and each egg is placed in its own special cell—worker eggs in worker-cells, and drone eggs in drone cells. After a few days the eggs hatch white grubs, which are attended by nurses. Nearly all spiders enclose their eggs in a silken cocoon, which, in some species, the mother carries on her back: 2,000 young spiders have been found in one cocoon. The eggs of domestic fowls are very nutritious.

Ei′der Duck. [Scand.] A sea-bird, which spends the winter on the Arctic seas, and when spring comes swims with its mates to the shore. The female makes a large, loose nest of dry grass, and lines it with a thick layer of down plucked from her own breast. The natives rob the nests of this down, and when it is replaced rob them a second time. Then the male bird strips himself of his down to line the nest, which is now left undisturbed. The female lays from six to ten pale-green eggs. Eider down is valuable for its softness and lightness, and the eggs are much liked as food. The eider duck does not fly well, but is early taught to swim and dive, the mother going down to the sea with a little one under each wing.

El′der. [AS.] A small tree or shrub with soft pith, white flowers, and black, red, or purple berries.

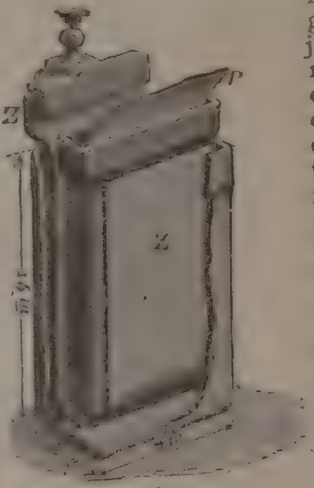
The berries are diaphoretic and aperient. Elder-flower water, made from the flowers, is a perfumed water used in perfumery and confectionery.

Electric′ity. [Gk.] This name was originally applied to certain attractions and repulsions, but the subject has gradually widened so as to include various chemical heating, luminous, magnetic, and mechanical effects. Electricity is considered under the two heads of (1) Statical or Frictional Electricity; and (2) Current or Voltaic Electricity.

Diagram Showing: A, four cells in series; B, four cells in parallel; and C, three in series with two in parallel.

Statical Electricity. As early as 600 B.C., Thales and other Greek philosophers discovered that amber (hence the name electricity, from Gk. *electron*, amber) when rubbed with silk attracted light bodies; and about 1600 A.D., Dr. Gilbert found that glass, sulphur, sealing wax, resin, and many other bodies were possessed of the same property. When glass is rubbed with silk, the glass is said to be electrified *positively*, and the silk, which has been the rubber, *negatively*; but wax rubbed with silk or flannel is *negatively* and the silk *positively* electrified. The existence of two kinds of electricity is shown as follows: A small pith ball is hung by a silk thread from a glass support, forming an electric pendulum. When a glass rod which has been rubbed with silk is brought near the pith ball, the ball is attracted by the glass; but as soon as it touches it, repulsion follows, and the two separate. If now a stick of sealing-wax be rubbed with silk, and brought up to the pith ball, the latter will be attracted towards the wax although it has just been repelled by the glass. This shows that a pith ball touched by electrified glass is afterwards repelled by the electrified glass, but attracted by electrified sealing-wax. This experiment shows two things: (1) that there are two kinds of electricity; (2) that two bodies charged with like electricities repel one another, and those charged with unlike electricities attract. The electricities here called positive and negative are also known respectively as *vitreous* and *resinous*. The electricity produced by friction has great electro-motive force, and is thus capable of overcoming great resistance, and of producing powerful mechanical effects; but it is deficient in quantity, and therefore does not possess a large amount of energy.

Current Electricity. A galvanic or voltaic cell or battery is an arrangement in which electricity is yielded by chemical action. Such electricity is named *current*, because it is continuous while the chemical action lasts, and not intermittent, like the momentary discharge from a Leyden jar.



GROVE'S CELL.

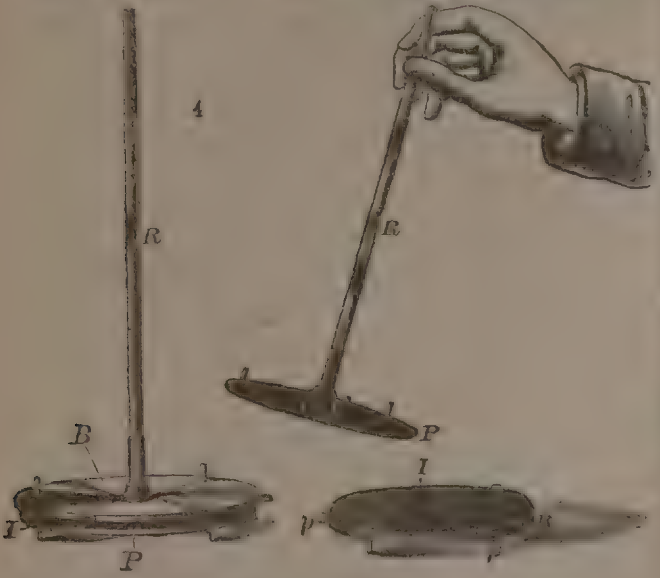
Z, zinc plate in dilute sulphuric acid; P, platinum plate in strong nitric acid.

A current may also be generated by heating the junction of two dissimilar metals; the electricity obtained in this way is called the thermo-electric current, the heat being transformed into electricity. Another method of obtaining a current is by rotating a coil of wire between the poles of a magnet or of an electro-magnet, as in the dynamo which yields electric light and power. The chief subjects which require to be considered under the head of Current Electricity are (1) the effect of the current in producing chemical decompositions; (2) in producing heat and light, as in electric lighting (*q.v.*); (3) the production of induced currents by the action of another current or of a magnet; (4) the measurement of the strength of the current, as with the galvanometer. (See *Galvanometer*, *Ether*.)

Elec′tric Light. Two forms of electric light are used—the *arc* and the *incandescent*. When a strong current passes between two carbon points which have been first in contact and are afterwards separated a short distance, the interval between them is occupied by a luminous band (known as the voltaic arc). This constitutes the *arc* light. Its light is very intense. The common street light is equal to about 800 candle-power, but the powerful search light may equal more than 50,000,000 candles. In the *incandescent* lamp the current is made to pass through a strip of carbon which has been carefully prepared and formed into a loop. This becomes intensely hot, and gives out much light. It is enclosed in a small glass globe, from which the air must be removed or a vacuum formed, otherwise the heated carbon would unite with the oxygen and the air be consumed. This light is suitable for household use. The current is supplied by an electro-magnetic machine.

Elec′tric Tele′graph. A system of conveying intelligence to a distance by means of signals produced by aid of the electric current. The two stations, which may be several thousand miles apart, are connected by a wire along which the electricity flows. The electric current, produced by a galvanic battery, passes along the wire with immense velocity, and is capable of acting upon an electro-magnet at great distances. In the common Morse system the sender uses a small instrument, by tapping which with his finger he can break off the current at will. When this is done quickly the receiving instrument gives a quick sound, or makes a dot on paper. When slowly, there is a longer sound, or a dash on paper. These dots and dashes are variously combined to represent the letters of the alphabet. These are now caught by the ear, paper not being used. Telegraph lines are usually carried through the air on wooden poles, galvanized iron being used. Telegraphs also pass under the oceans, their wires being surrounded by insulating material, the whole being called a cable. Telegraphing without wires has recently been invented.

Elec′tro-met′allurgy. The art of depositing metals—such as gold, silver, copper, etc.,—from their solutions by a slow current of electricity, obtained either from a voltaic or a magneto-electric battery. The process is mostly confined to electro-typing and electro-plating.—*Electro-typing* is the method of securing copies of medals, statuettes, etc. When copper, for example, has to be deposited upon a mould (made of plaster of Paris or gutta-percha), the mould is made a conductor by brushing it over with black-lead; and, after attaching it to the negative pole of the battery, it is suspended in the solution of sulphate of copper, the positive pole consisting of a plate of the same metal. By the electrolysis of the solution copper is deposited on the surface of the mould, while sulphuric acid is set free; and this, by dissolving a portion of the copper at the positive pole, keeps the solution at constant strength.—*Electro-plating* is the process of covering forks, spoons, etc., made of the cheaper metals, with a coating of silver. The process is in reality electro-typing in silver instead of copper. The solution of silver (called the bath) consists of two parts of cyanide of silver, 10 of cyanide of potasssium, and 250 of water. By the electrolysis of this solution silver is deposited on the object which is placed in it.

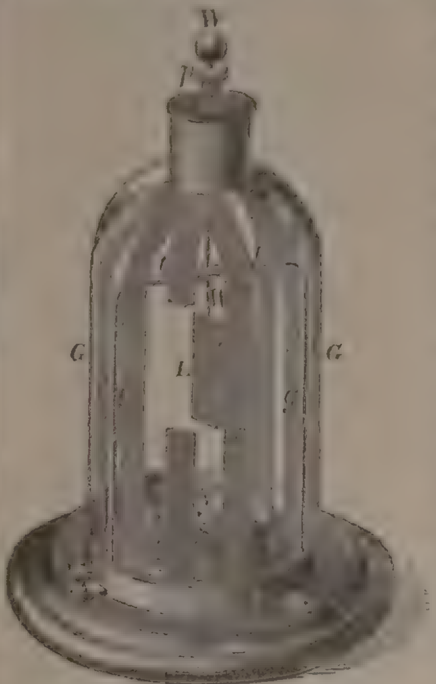


ELECTROPHOROUS.
I, Ebonite plate; B and P, upper and lower plates of brass; R, insulating handle for upper plate.

Electroph′orous. An apparatus for generating frictional or statical electricity. By striking or rubbing the ebonite with dry flannel and then placing thereupon the upper plate of metal and touching the upper and lower metal disks simultaneously, upon removing upper disk a discharge of electricity will be then felt upon touching the upper disk.

Electrom′eter. An instrument for measuring the force or power of an electric current.

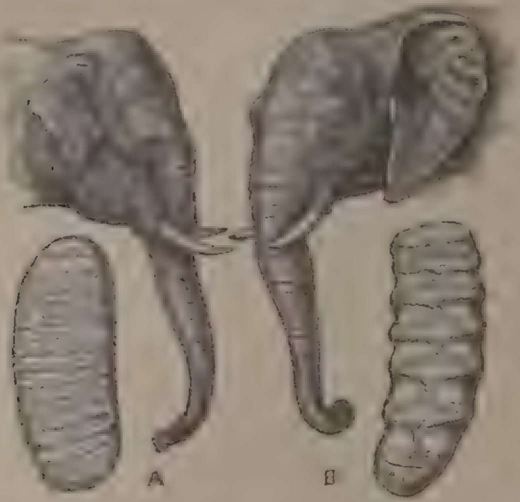
Elec′troscope. An instrument for measuring or detecting pressure of electric current. By rubbing a glass rod with a piece of silk and touching the knob *W*, the strips of gold leaf will part indicating pressure of electricity.



GOLD-LEAF ELECTROSCOPE.
G G, Glass shade; L, gold leaves supported by wire w; gg, glass supports for w; v, vessel containing sulphuric acid; p, small plug to be pressed down when instrument is not in use.

El′ements. [L.] Substances which cannot be decomposed by chemical action, and which seem to be unit forms of matter, as distinguished from compounds. They are roughly divided into two great classes—the metals, and the non-metals or metalloids. The number of elements now known is about 75, but some of these may not be simple bodies, but compounds of simpler bodies.

El′ephant. [Heb. *aleph*, an ox.] The largest and most powerful of four-footed animals. It is clumsy and thick-skinned, but has a lithe and agile trunk. Some elephants have been found 12 feet high and over five tons in weight. They can carry great burdens at a rate of two or three miles an hour. Their legs are massive, but they can kneel and rise easily, and can use their fore feet as hands in holding down branches while the leaves are being stripped off by their trunks. The feet of the elephant are divided into toes, though externally gathered into a round cushion mass, protected by flattish nails. Compared with its body, its head is small, and the skull contains many hollow spaces, which lessen its weight. It has pendulous ears, gigantic tusks in the male, and a trunk which can reach 8 or 10 feet. The tusks, which are the incisor teeth of the upper jaw, are weapons of defence or forks to dig up roots. The eye is small but brilliant, and its inability to look backward or upward is made up for by great acuteness of hearing. The trunk, which is the nose lengthened out, is of a tapering form, and is composed of thousands of minute muscles, which give it great power in feeling and grasping, or in pumping up or ejecting water. The trunk conveys the food to the mouth or draws up water which is thrown over the back. The elephant is herbivorous, and feeds on grass, young shoots, and roots; it is found in Central and Southern Africa, and in India. Elephants are captured by enclosing them in palisades of timber. They are intelligent and sagacious, and can be trained to do many kinds of work and many feats. The African elephant has great flapping ears, and is more fierce than that of Asia. Its tusks yield fine ivory, which is very valuable. The Asiatic elephant is smaller than the African. The tamed elephants in menageries are of the Asiatic kind.



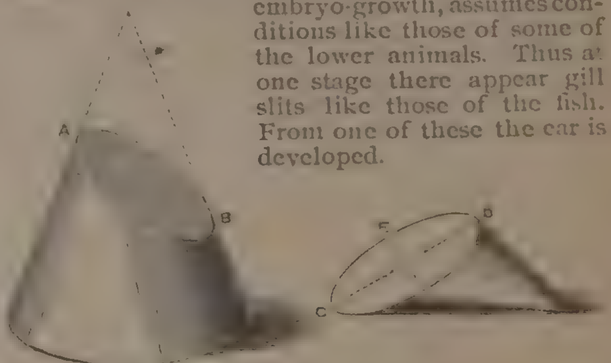
El′evator. [L.] A machine for raising grain, etc., to a higher floor—usually an endless chain with a series of scoops or buckets; also, a cage or platform or hoist for hoisting persons or goods. The passenger elevator is largely employed in the lofty buildings of recent times. By its aid buildings many stories high are easily used. It is called a *lift* in England.

Elk. [Scand.] A large species of deer. The European elk has long, flat horns, and is closely allied to the moose. The American elk is known as the wapiti, and is of large size, being about as large as the horse. Its horns are the finest of all deer horns, being 5 or 6 feet long, and having many branches.

Ellipse′. [Gk.] A curve of such form that every point on it has the sum of its distances from two fixed points always the same. The two points are called the foci. The orbits of the planets are ellipses, with the sun in one focus.

Elm. [AS.] A large and graceful forest tree with thick foliage of dark-green leaves. It has smooth bark on the branches, but a rugged trunk. Its flowers are dark red, and bear an oval green pod with one seed. This tree is often planted in rows in parks, and is very common in England. Its wood is hard and tough, and used for water-wheels, building, shipbuilding, carving, etc. Its bark is used in tanning, dyeing, and sugar-refining. The American elm is called white elm; a red elm, called slippery elm, has a succulent inner bark, whose jelly-like juice is used in medicine.

Embryol′ogy. The science of the development of the animal body from the germ to the mature state. It has been discovered that man, in the embryo-growth, assumes conditions like those of some of the lower animals. Thus at one stage there appear gill slits like those of the fish. From one of these the ear is developed.



CONE CUT TO SHOW THE ELLIPSE.

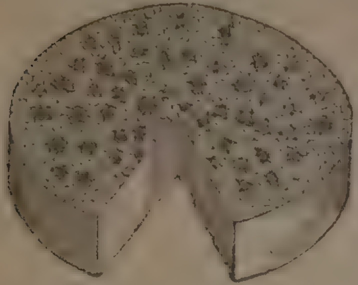
Em′erald. [Fr., from Gk.] A variety of the mineral beryl, of a beautiful green color; when transparent it is much prized as a gem. The finest stones come from Colombia, in South America, and fine ones are found in Peru. Inferior emeralds come from Bavaria, India, and Mt. Zalvra in Upper Egypt. Large crystals of emerald occur in North Carolina and Siberia.

Em′ery. [Gk. *sman*, to rub.] A variety of corundum, occurring in grains or powder, and very hard. It is glued on cloth, paper, or the rim of a wheel, and used for grinding and polishing hard substances. It is found in the island of Naxos, in the Grecian Archipelago, and other places.

E′mu or **E′meu.** [Port.] An Australian bird related to the cassowary and ostrich, and, next to the ostrich, the largest of birds. It cannot fly, but runs swiftly. The emu kicks backward or sideways, while the ostrich kicks forward. Emu feathers are scarcely distinguishable from ordinary hair. The male bird hatches and broods the young. In its wild state it feeds on parrots or other birds; but it is often made a household pet, though mischievous and cunning. It is the only running bird that wanders in pairs. Its eggs are of a beautiful dark-green color.

Enam′el. [Fr., from Ital.] In pottery, a substance of a vitreous nature applied as a coating to the surface of pottery or porcelain. It is a fusible kind of glass, and is either transparent or opaque, and when transparent it forms a glaze. An enamel of a similar kind is used as a lining for the inside of iron vessels used in cooking. In the fine arts it is a substance applied as a coating for decorative purposes on the surface of porcelain or metal.—*Enamel work*. In this kind of work the chief decorative quality lies in the manner of its execution. There are distinct classes of it, as *Cloisonnee*, *Champleve*, *translucent*, and *surface* enamel.

En′dogen. [Gk.] A plant that grows by adding new wood to the interior of the stem, as a palm, rush, or orchid. Opposed to exogen (*q.v.*). The leaves have usually parallel veins, and their flowers are in three or multiples of three parts. Endogens have no bark, because, the flow of sap being internal, bark is not required to defend the sap, as in exogens. The Endogens include palms, lilies, orchids, etc.



En′gine. [Fr., from L. *ingenium.*] A machine fitted to do work or set machinery in motion. There are various kinds—steam-engine, air-engine, fire-engine, pumping engine, and donkey-engine. Military engineering includes the designing and building of fortifications; civil engineering includes the building of railways, canals, water-works, bridges, lighthouses, docks, and tunnels; mining engineering has regard to the sinking and working of mines; electrical engineering includes all kinds of electrical work.

En′signs. [L. *insignis.*] The flags of a regiment, usually two, and referred to as colors. In America they are carried by color-sergeants. The rank of ensign, formerly used in the British army, was abolished in 1871.

Ep′aulet. [Fr., from L. *spatula.*] A mark of an officer, naval or military, worn on the shoulder, formerly used.

Ep′som Salts. The ordinary name for sulphate of magnesium; so called because it occurs in a spring at Epsom in Surrey, from the water of which it was originally prepared. It is now manufactured from mountain limestone, the lime being separated by sulphuric acid. It is found native in America, and may be also prepared from sea-brine. It is used in medicine as a purgative. It has a bitter, saline, disagreeable taste, which may be somewhat relieved by adding a little lemon syrup.

Er′mine. [Fr.] An animal like a weasel, having a thick, valuable fur, worn by judges and royalty as emblem of authority. In summer it is brown, but in winter it is white. The tail is always black; and these tails are arranged at intervals through the fur when worn in state robes. It is named from Armenia, where it was first found; but now it is found in the north of Asia, Europe, and America.

Escape′ment. [Fr.] The means in a clock or watch by which the force of the weights or spring is checked and regulated by the motion of the pendulum, or balance acting on a wheel with sharp teeth. They are known as the verge or upright, the anchor-shaped, the cylinder, the duplex, and the lever.

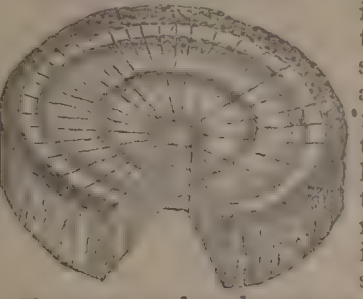
Es′sence. [L. *essentia*, being.] The volatile matter forming a perfume. Essential oils, extracted from various plants, fruits, and flowers are used in essences and perfumery.

Etch′ing. [Du.] A picture made from an etched plate, chiefly copper. In etching, the plate is covered or dabbed with a varnish, and is scored or scratched with a needle, so as to form the drawing; it is then covered with nitric acid and water, which bites the metal in the lines laid bare.

E′ther. [Gk. upper air.] A medium of extreme tenuity, which is assumed to pervade all space, and the interstices between the molecules of all bodies, whether solid, liquid, or gaseous. It is the medium by means of which light, heat, electricity, and magnetism are transmitted, it being claimed that diffused matter cannot convey these forces, and that a very rare substance, differing in character, is needed. Sulphuric ether is obtained by distilling strong alcohol and sulphuric acid, and is an exceedingly volatile and inflammable body, dissolving fats, resins, and oils, and useful in removing grease stains. It is also used as an anæsthetic.

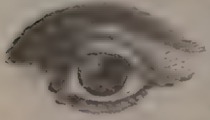
Eucalyp′tus. [Gk.] An Australian evergreen tree like the myrtle, which grows to a great height, and yields resins, oils, tars, and tannin. The leaves are rigid, with one edge turned to the zenith. They are called *gum-trees.* The timber is valuable. The Tasmanian cider-tree is a eucalyptus, and yields a cider-like sap in spring. A eucalyptus tree in Cape Otway Range, Australia, is 415 feet high. These trees have been widely transplanted and are thought to be of value in malarious districts, as in the Roman Campagna.

Ex′ogen. [Gk.] A plant that grows by adding its new wood round the outside of the stem, under the bark, as is done by most forest trees of the temperate zones. The leaves are usually net-ted-veined, and the number of cotyledons is two, or very rarely several in a whorl. Exogens and endogens are the principal classes of the vegetable (*q.v.*) kingdom.



Eye. [AS.] The human eye is a nearly spherical ball, which in an adult is about nine-tenths of an inch in diameter. The external coating, known in common language as the white of the eye, is a tough, horny membrane, having about four-fifths of its circumference opaque, and named the *sclerotica.* The front portion of this coating, called the *cornea*, is transparent and more curved than the sclerotica. Behind the cornea is a flat circular membrane called the *iris.* It is colored, and at its centre there is a circular opening called the *pupil*, which is capable of becoming contracted or enlarged on exposure to light or darkness. The color of the iris gives the characteristic color to each person's eyes. Behind the pupil is the *crystalline* lens. The cavity between the cornea and the crystalline lens is called the *anterior chamber*, and contains the *aqueous humor.* The cavity behind the crystalline lens, called the *posterior chamber*, contains the *vitreous humor.*

The sclerotica is lined by a dark-colored membrane called the *choroid coat*, saturated with a black mucus. The choroid is lined with a membrane called the *retina*, which is traversed by a system of nerve filaments coming from the optic nerve. Light falling on the retina produces the sensation of vision, and this is the only part of the eye which possesses this property. When the rays of light from an object enter the eye, they undergo refraction at the cornea and the crystalline lens, and come to a focus on the retina; if the image formed on the retina is distinct, the object is seen clearly. The eye can accommodate itself so as to be able to see objects at different distances; this is supposed to be brought about by a change in the focal length of the crystalline lens. The prawn has a pair of gleaming eyes standing out upon short stalks, which are composed of a number of six-sided facets in the shape of a hemisphere, by which the prawn keeps a sharp look-out. The snail also has eyes set on long stalks. Bees, butterflies, beetles, ants, flies, house-crickets, and other insects, have compound eyes. The eye of the grasshopper often consists of 12,000 lenses, with a glass-like cone and thread-like rods forming the image. Many of the molluses and other low forms of life have eyes.



F

Fakir′. A member of an order of penitents or mendicants of Oriental lands, particularly India. Some of them live in communities, others wander about, making unpleasant displays of self-torture and mortification and of filthy habits. The term has recently been applied to itinerant street salesmen.

Fair′y. A fay; an imaginary being of tiny human form, supposed to dance in meadows, steal infants, and play a variety of pranks. They are regarded as sometimes benevolent, sometimes malicious, and to concern themselves greatly with human affairs. The popular belief in fairies has largely died out, but has left a literature of ceaseless charm to the young and imaginative.

Fahr′enheit. A method of marking thermometers (*q.v.*) so called from the inventor, *G. D. Fahrenheit.* Its freezing-point is 32°, and boiling-point 212°. This thermometer is in common use in England and in the United States.

Faith-Cure. A system in which it is claimed that the sick can be cured without medicine, needing only faith in certain persons or objects to produce this effect. Christian Science and some other systems seem based on a similar principle.

Fal′con. [L. *falx*, a reaping-hook.] A bird of prey with claws like a hook. This bird used to be trained to catch other birds for hunters. Eagles, buzzards, and hawks, and most birds of prey, belong to the class of Falcons. All have the same tearing beak—a tooth-like lobe on the upper mandible—and all the same hooked claws. They lay from two to four eggs in the year. The peregrine falcon or hawking falcon is a trim, brave bird. Hawking with the falcon is still practiced in Persia and India. The gyrfalcon is an Arctic bird.

Fall′ing Stars. The flashing meteors which dart across the sky at night and quickly disappear. At certain periods of the year they are seen in large numbers, and yield the impression of stars falling from their place in the heavens.

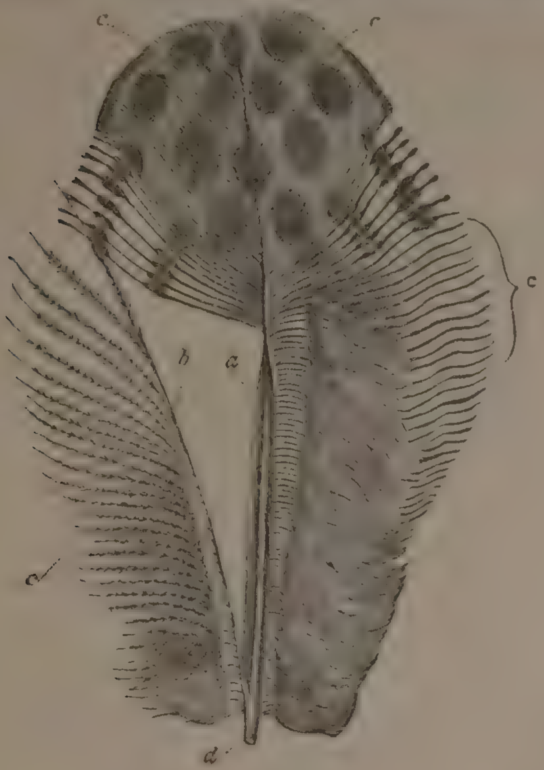
Fal′low Deer. [AS.] A deer of a fallow or pale yellowish-brown color, smaller than the red deer. In summer both sexes are spotted with white. It is a native of Persia, but is now domesticated in Europe.

Fan. [AS., from L.] An instrument for blowing away chaff, or for moving the air to cause coolness, or to blow a fire. Ladies' French fans are made of ivory, mother-of-pearl, tortoise-shell, bone, gauze, or feathers. Cheap fans from India and China are palm leaves or split bamboo. Large machine fans, moved by steam power, are used for many purposes, and electric fans to cool large rooms in summer.

Fari′na. [L. *farina*, meal.] Ground corn or fine meal made from cereal grains or from the starch extracted from vegetables, and used in cookery. —*Farinaceous food*, food consisting of meal or flour.

Fat. [AS.] The soft, oily part of an animal's body. Carbonaceous foods act both to yield animal heat and to form fat, which is of use to the animal in protecting it from the cold and forming a store of food. Some fats are *solid* at ordinary temperatures. These include beef suet from the ox, mutton suet from the sheep, lard from the pig, butter from milk, dripping, melted fat from meat. They become liquid when heated, and are chiefly composed of stearin. Liquid fats are commonly called oils, and include olive oil, cod-liver oil, etc. Oils (*q.v.*) are composed of olein, and contain less hydrogen than solid fats. Fat is lighter than water, and is insoluble in water. Benzole or benzene will dissolve fat, and is much used to remove grease spots from clothing.

Fea′ther. [AS.] A stalk of horn, hollow at the lower end or quill and filled with pith, and fringed at the other end, forming part of a bird's wing or the covering of its body. Birds are the only animals that are clothed with feathers, and much of their beauty is due to the colors and markings of the feathers. Feathers grow from little sacs in the skin, and are horny and of much the same substance as the scales of reptiles. Soft downy feathers, which overlap one another, form the warm covering of the body. The large quill feathers of the tail and wing are useful for flying. On each side of the quill are barbs, which, cleaving closely to their neighbors by hooks or barbules, make up the web or vane. Lower barbs of a feather and downy feathers have no hooks on them. The tail feathers of the ostrich and other such birds also have no hooks. Birds always preen or trim their feathers with oil taken from an oil-gland at the end of the tail. This oil is most abundant in water-birds, and makes their feathers waterproof. Partridges and scratching birds have dingy feathers like the ground on which they live; pheasants and brilliantly-colored birds blend with the bright flowers and pretty fruits upon which they feed. The feathers of various birds form an important article of commerce. Feathers are useful as articles of trimming and ornament, and for the stuffing of beds and pillows. The quills of feathers were formerly made into pens, but the extensive manufacture of steel pens has supplied their place. Feathers for ornament are obtained from the ostrich, marabout, peacock, pheasant, bird of paradise, heron, osprey, and other birds.



FEATHERS.

a, d shaft; *b*, aftershaft; *c*, barbs or web.

Felt. [O.E.] Cloth made of the shortest fibres of wool, or of wool and fur of hares and rabbits, not woven but mixed with thin glue, and rolled or pressed together. After being switched up into fluff by *bowing*, it is carded and twisted into a soft, loose cloth, which is wound on a roller and carried to a felting machine, and then dyed. Fine felt is used for hats and coarser felt for table cloths, carpets, roofing, lining buildings to prevent dampness, and many other purposes.

Fermenta′tion. [L. *fermentatio.*] A change which many organic liquids are capable of undergoing in the presence of certain substances termed *ferments.* The decompositions which take place are different from ordinary chemical actions, and the resulting products vary with the nature of the fermented body and with the kind of ferment used. There are two distinct kinds of ferments—(1) *organized*, and (2) *non-organized*, or soluble ferments. The former consist of minute vegetable organisms. One is yeast, which gives rise to the alcoholic fermentation, producing chiefly alcohol and carbonic acid; another, called bacterium lactis—a rod-like form—is the cause of the fermentation in milk, or lactic fermentation, the chief product of which is lactic acid; a third produces acetous fermentation, giving rise to acetic acid, and there are many others.

Fern. [AS.] An order of plants belonging to the class of *acrogens.* They are usually found in moist soil, sometimes they grow as parasites on trees, and in the tropics reach so large a size as to be called tree ferns. The brake or bracken, polypody, asplenium, maidenhair, are all well-known ferns. They bear clustered cells filled with spores, which germinate and form minute growths, on which are borne the true organs of reproduction. These spores are generally produced in rows on the back of the leaves, or *fronds*, as they are usually called; or sometimes on a central branch or spike. There are more than two thousand kinds of ferns in the world.

Fer′ret. [Fr.] An animal of the weasel kind, about 14 inches long, used for hunting rats and rabbits out of their holes. It is like the weasel in form, has red eyes, and its fur is of a light brown, pale yellow, or white color. When used for rabbit-hunting its muzzle or jaws are tied together; and as it cannot bite the rabbits, they are driven to the entrance of their burrows, where they are netted or shot. The ferret in winter must be protected from the cold. It is a native of Africa, but has been domesticated in Europe.

Fe′ver. [Fr.] An illness causing great heat in the body and quick action of the heart. Remittent fevers subside at intervals; intermittent fevers entirely cease at intervals; continued fevers neither abate nor intermit.

Fi′bre. [Fr., from L. *fibra*, a thread.] The thread-like parts in the flesh of animals; also those in the stalks of such plants as hemp, flax, agave, jute, cotton, etc., from which thread, string, rope, and paper are made; also the hairs and wool of animals, the thread of the silkworm, and other substances used in weaving, etc.

Fi′brin. A substance which separates in a solid state from blood after it leaves the body. It is a white, stringy substance, which may be readily obtained by stirring newly-shed blood. It is tasteless, insoluble in water, but is readily digestible in gastric and pancreatic juice, and when dried forms a heavy mass resembling albumen.

Fife. A small wind instrument used with the drum for military music. It is a short tube closed at one end, with holes in the side. It is very ancient, having been used by the old Greeks.

Fig. [Fr., from L. *ficus*, a fig-tree.] A small fruit-tree of from 12 to 20 feet high, with large leaves. The fig is a native of Syria, and grows wild on the Mediterranean coast. It bears two crops annually, and when the fruit is picked it is spread out to dry. Fig-cake is used in the East instead of bread.

File. [AS.] A piece of steel made rough for smoothing wood or metal. A file differs from a rasp in having the furrows made by straight cuts of a chisel, either single or crossed, while the rasp has coarse single teeth. There are many shapes — flat, square, knife-edged, half-round, rat-tail or round, three-square, cross, and slitting.

FIGS.

Fil′igree. [Span.] Fine thread-like work of arabesque pattern, made of gold or silver wire or wire used in decorating gold or silver. It is made mostly in India, Turkey, Italy, and Malta.

Fil′ter. [From root of *Felt.*] Any substance, as charcoal, sand, or felt, through which liquid passes, and by which it is cleared of foreign substances. Filters are much used for obtaining pure drinking water, and are employed on a large scale in purifying the water-supply of cities.

Fine Arts. The arts designed to appeal to the artistic taste and give pleasure to observers, as distinguished from the useful arts, designed to benefit mankind. They are usually restricted to the arts of painting, sculpture, and architecture.

Fins. [AS., from root of L. *penna*, a feather.] The parts of a fish by which it balances itself and moves forward in the water. The paired fins on the opposite sides of the body are the true limbs of the fish. Those near the gills behind the head are the pectoral fins, and represent the fore limbs of quadrupeds; those below are the ventral fins, and represent the hind limbs; those on the back are dorsal or first and second dorsal; those underneath near the tail are the anal fins, and the tail itself is the caudal fin. These are used as its means of motion and the tail also serves as a rudder.

Finch. [AS.] The name of a family of song-birds, as chaffinch, goldfinch, bullfinch. Many of the finches are beautiful singers, and others are prized for their delicate flesh. They frequent fields, groves, hedgerows, etc., and feed chiefly on grain and seeds. The common sparrow, an European bird now abundant in the United States, is the true type of the Finch tribe.

Fir. [AS.] The name of several kinds of coniferous trees, producing valuable timber or resin. Firs, such as the balsam fir, the silver fir, and the red fir, are large in size and elegant in shape, and belong to the genus *Abies*. The silver fir on the Pacific coast grows to a height of 200 feet.

Fire-engine. A machine by means of which water can be thrown to a great height for the purpose of extinguishing fires. The principle of its action is the same as that of the force-pump (*q.v.*); but in a force-pump the stream of water is intermittent, flowing only at each descent of the piston. This is obviated in the fire-engine by employing a strong air-vessel, into which the water is forced, the compressed air reacting on the water so as to keep up a steady flow. In the force-pump there is only one cylinder, but in the fire-engine there are two, in which the pistons are worked simultaneously, one ascending while the other descends. Fire-engines were formerly worked by hand, but now steam fire-engines are widely employed.

Fire′fly. A small insect which gives out a bright light in the dark. All glowworms are called fireflies or firebeetles, but the American firefly, which generally sparkles in humid districts, is called Photinus, and both sexes are winged.

Fire′works. Preparations of gunpowder, sulphur, metallic filings, and salts, to be set on fire. The most common form of firework is a pasteboard tube filled with these explosive materials. A number of these tubes are often arranged so as to make, when kindled, a great variety of figures in fire variously colored. Stars are made of nitrate of strontia and gunpowder. Rockets are used in war and as ship signals, as well as in pyrotechnic displays. The life-saving rocket consists of a drawn steel tube with a composition that expels the gases with a pressure of 60 tons to the square inch. It is used to carry a rope to a wrecked vessel near the coast.

Fish. [AS.] A vertebrate animal covered with scales that lives almost entirely in water, has no lungs, and breathes through gills. It lays eggs, and, having a heart with only two chambers, its blood is cold or of the temperature of the air. All the seas and rivers abound in fish. The true fishes include the *teleostei*, or ordinary bony fishes; the *Ganoidei*, as the sturgeon; the *Dipnoi*, or air-breathing fish, of which there are a few species; the *Selachians*, or sharks and skates. Fishes are usually covered with scales

THE GLOBE FISH.

(*q.v.*), which overlap each other, and are moistened with a kind of slime. Many of them are of beautiful colors—gold, silver, and copper tints, and attractive shades of blue, green, red, and black. Fishes swim chiefly with the tail, and their fins (*q.v.*) help them to keep their upright position in the water. They are rich in nitrogenous material, chiefly albumen and fibrin. Some fishes—as salmon, herring, mackerel, and eels—also contain much oily matter, which makes them not so digestible as whiting, sole, etc. Among the fishes most useful as food for man are the cod, salmon, mackerel, pilchard, and herring.

Fish-culture. A method now widely adopted of planting the eggs of fish and guarding the young against their enemies. In this way many millions of young fish are raised and placed in the streams annually. The United States Fish Commission thus distributes over 250,000,000 young fish every year. The same principle is also applied to the lobster, the oyster, and other food animals.

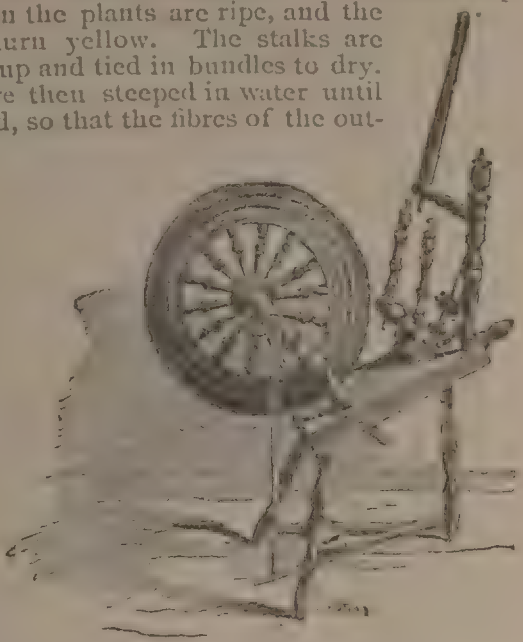
Fish′hawk. The American fishhawk or osprey is found over nearly the whole country. It is a large bird, looking much like the eagle, some of them measuring over five feet across the wings. It lives on fish, darting into the water to seize them. It is often robbed by the bald eagle, which forces it to drop the fish and then swoops down and seizes it in its fall.

Flag. [Scand. to hang loosely.] That which flies or flutters loosely in the wind, but more especially a banner bearing a device or devices, and used to indicate nationality or to give information. *Flag of truce* is a white flag exhibited to an enemy to invite a conference. *Yellow flag* is the quarantine flag, and at the fore of a ship indicates that infectious disease is on board.

Flame. [Fr., from L.] The illumination given by burning gas. Heat is produced by the chemical action which takes place during combustion, the temperature of the burning material being raised sufficiently high to give out light or to produce flame. The structure of flame can be most easily observed in a candle, lamp, or ordinary gas flame. When a gas flame is lit, it is seen that the part nearest to the burner is only feebly luminous. This consists of the gas which has just escaped from the pipe, and, though to some extent heated, has not begun to unite with the oxygen of the air. As the gas rises higher, it comes into contact with oxygen and unites with it. At first the hydrogen of the gas unites more rapidly with oxygen than the carbon, and in consequence a number of particles of carbon are set free, which, on becoming intensely heated, give rise to a bright flame. The illuminating power of the flame is due to the particles of glowing carbon, which, as they rise higher, are consumed on the border of the flame in contact with the atmosphere. In order to give out much light, a flame should contain solid matter; but the most luminous flames are not necessarily the hottest.

Flamin′go. A wading-bird of several species. It is of a brilliant red, and has a long neck and legs. In feeding, the head is bent downward and inward so as to reverse the position of the upper mandible. The nest is made of mud scratched up two or three feet high, and two eggs are hatched, the bird standing so as to rest on the tall nest. The red flamingo posts sentinels, which give warning of danger with trumpet notes.

Flax. [AS.] A plant about two or three feet in height, with small pointed leaves and blue flowers. The stems are hollow, and covered with fibrous material. The flowers grow in clusters at the top of the stalks, and are succeeded by round seed-vessels the size of a pea. Each seed vessel contains ten flat seeds of a brown color. It thrives in a rich, moist soil. The leaves drop off when the plants are ripe, and the stems turn yellow. The stalks are pulled up and tied in bundles to dry. They are then steeped in water until softened, so that the fibres of the outside covering or bark can be separated. The fibre of flax is spun and woven by machinery into linen, and then bleached by chloride of lime. Flax is grown in Europe and the United States, where it was introduced from England in 1629. Linen, lawn, and damask cloth are woven from flax-thread, and linseed oil is made from its seeds.



FLAX-WHEEL.

Flea. [AS.] A small insect without wings that moves by leaping, and whose bite is troublesome because slightly poisonous. The human-flea is abundant in Europe, but rare in America, where the dog-flea takes its place. The dog-flea infests dogs and cats, and is occasionally troublesome to man.

Flints. [AS., a hard stone.] Amorphous lumps of dark silica which occur in nodular sheets in chalk and other limestones. They often enclose such organisms as shells and sea-urchins; spicules of sponges abound in flint. The process by which flint has been formed is uncertain; but it is supposed to be due either to the abstraction of silica from sea-water by sponges, or to the decomposition of animal remains. *Flint-glass* is dispersive of light, and consists of silicate of lead and potassium. It is used for table-ware, and prisms, and is called crystal glass.

Floun′der. [Du.] A flat fish found near the mouths of rivers. There are many different kinds both in Europe and America.

Flour. [Fr., from L. *flos*, flower.] The finest part of meal or corn ground into fine powder. In milling, meal is separated into flour and bran, the meal being afterwards separated from the bran by *bolting* through a gauze-covered revolving cylinder. There are various kinds of flour, some fine, others coarse, and of different grains, as wheat, rye, etc.

Flow′er. [Fr., from L. *flos*, flower.] The part of a plant destined to produce seed. The flower is easily seen in such plants as the rose and the buttercup in which it is large and brightly colored; but grasses, too, and indeed all plants of a higher order have well developed flowers. In a buttercup, on the outside of each flower, are small greenish-yellow *sepals*, five in number, which form the *calyx*. Then come five large bright-yellow *petals*, forming what is called the *corolla*. Inside this, looking like little pins with yellow heads, are the *stamens*. In the centre of the flower are some green bodies called *carpels*, which together form the portion of the flower called the *pistil*. Every part of the flower has its use. The calyx protected the flower when it was a bud. The corolla attracts the insect to the flower. The stamens form pollen, which when placed on the pistil causes the carpels to swell and form seeds. The pollen is carried from the stamen of one flower to the pistil of another by insects. Flowers also contain nectar. It is the wind which carries the pollen of grasses and several other plants. (See *Fruit*.)

Flu′id. [Fr., from L. *fluidus*, flowing.] A substance; whose particles possess perfect freedom of motion among themselves, so that any force applied to it will, if not resisted, produce a change of shape. There are two classes of fluids —*liquids* and *gases*—and each class has some properties peculiar to itself.

Fluo′rine. [L.] A non-metallic element, never met with in nature in the uncombined state. It is the only element which does not combine with oxygen. It is most frequently found combined with calcium in the mineral fluor-spar. In minute proportions it is widely diffused in the waters of some springs, rivers, and the sea, and in the bones of animals. Combined with hydrogen it is used in etching glass.

Flu′or-spar. A mineral found in veins, very often accompanying lead ore. It occurs both crystallized and massive. The crystals belong to the cubic system, and are either colorless, green, purple, or yellow. When heated it becomes phosphorescent. It is used as a flux, and some varieties are employed for ornamental vessels.

Flute, [Fr., from L. *flare*, to blow.] A light wind-instrument played by the mouth on a lateral hole, and by the fingers, which stop holes along its length or open keys.

Fly. [AS.] A name applied to many of the winged insects, but scientifically restricted to the sub-order *Diptera*, which have two wings and whose mouth-parts are converted into a sucker, used for taking up fluids. The sucker acts as a lancet, by which the skin of animals and vegetables is pierced so as to reach the blood or sap. The flies comprise many thousands of species, differing greatly in size, the best known being the common house-fly.

FLY'S FOOT MAGNIFIED.

Flying-fish. A fish that can leap into the air with a spring of its tail, and keep itself up by its fins for a time as if flying. Its pectoral fins are developed so as to act like wings. It can fly for hundreds of yards, and is frequently attacked by sea-birds and dolphins (*q.v.*). It has a bladder that can be inflated to fill the whole cavity of the abdomen; it has also a membrane that is inflated through the gills. The California flying-fish is said to fly for nearly a quarter of a mile, usually not rising more than four feet. There are several kinds, which are found in tropical seas.

Fly-wheel. A contrivance for regulating the driving power of a machine. In the steam-engine the power of the connecting rod to turn the crank varies with their relative position. When the rod is at right angles to the crank its turning effect is greatest, and when they are in the same straight line this power is *nil*. There is thus introduced a cause of unevenness in the motion through the whole length of the stroke. To obviate this difficulty the *fly-wheel* is fixed on the axis. This is a large wheel with a heavy rim, which, when once started, requires little work to keep it in motion; but, since it possesses much energy in consequence of its motion, it acts to make uniform the motion of the rod and crank.

Fog. [Celt.] When the vapor in the air reaches the point of saturation (see *Dew*) it condenses, and assumes the form of very small drops, which constitute *fog* if they are present in the lower regions of the atmosphere, and *cloud* if in the higher. Fogs are therefore of the same nature as clouds (*q.v.*). Fogs may be caused by the flow of a current of warm moist air over masses of ice, such as are sometimes encountered in the Atlantic, and are often seen on the Banks of Newfoundland.

Fog Signals. Signals to prevent the collision of vessels in foggy weather. Many methods of signalling have been tried, the best being the whistle and the trumpet. The most powerful is the siren trumpet, whose sound can be heard for more than 20 miles.

Folk-lore. The study of ancient legends, rustic tales, superstitions, etc. This term has been used since 1846, and great collections of the beliefs, customs, and popular tales handed down from the far past have been made.

Food. [AS.] All substances used for purposes of nutrition. The useful constituents of all foods—animal, vegetable, and mineral—are classified as (1) nitrogenous, including the animal and vegetable albuminoids and gelatin; (2) fatty, including animal and vegetable fats and oils; (3) carbohydrates, including starch and the sugars; (4) salts organic and inorganic; (5) water. In addition to the vegetable and animal foods consumed for the support and growth of the body, there are also needed lime, iron, soda, potash, chlorides and phosphates, etc. Water is very necessary, since it forms two-thirds of the weight of the body. A very great variety of foods and combinations of nutritive materials are used by man.

Fools'cap. A size of paper 16 by 13, which used to have as its water-mark a *fool's cap and bells*.

Foot. [AS.] That part of the body on which animals stand and walk. There are 26 bones in the foot and ankles of man. To these are fastened a great number of ligaments and muscles, by which their movements are guided and varied. The foot of the chimpanzee is in many points like that of man, but the toes are longer, and it is not adapted for easy standing or walking. The feet of quadrupeds differ greatly. Some have five toes like man, some four or three, and in many cases—as in the oxen, deer, antelopes, camels, and others—there are only two toes, covered with horny hoofs. The horse has but one toe, covered with a strong hoof, which is really the nail greatly developed. What is called the knee in four-footed animals is usually the heel, lifted above the ground. Some animals walk, like man, on the flat sole of the foot; some, like lions and cats, on the bent toes; others, like the horse and ox, on the tip of the toe, which is covered by the hoof. Birds have usually four toes, three in front and one behind, the foot and toes differing as they are intended for perching, walking, wading, or swimming.

CLIMBING FOOT.

FOOT OF SCRATCHER.

TOE WITH SPUR.

FOOT OF PARROT.

Football. A game of kicking a ball with the foot between goals. The ball is usually made of India-rubber or a bladder, and is enclosed in a leather cover.

Foot-rule. A measure of a foot, or 12 inches, in length. It differs in length in different countries. In Britain and the United States it is .3048 metre.

Force-pump. A pump having a solid piston for drawing or forcing liquids like water through the valves. The force-pump delivers the water a considerable height above the pump. It is useful in draining cellars or low level places, and in fire-engines.

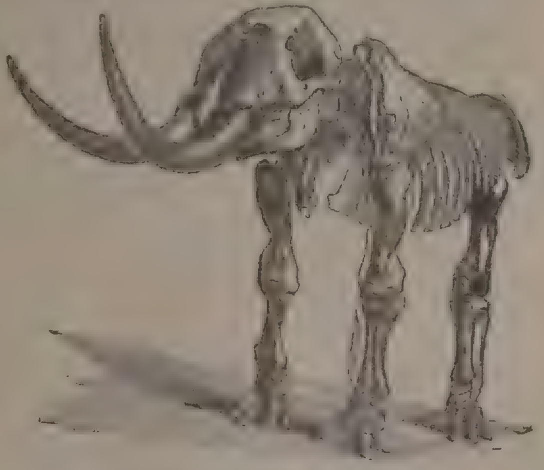
Fore'castle. [Pronounced by sailors *foksl.*] An upper deck before the foremast in a war-ship, which formerly had a turret near the prow or the front part of the ships where are the sailors' berths.

For'est. [Fr., from L. *foris*, out of doors.] A large piece of country covered with trees, or an unenclosed, uncultivated land on which wild animals are hunted. Forest-tree is a tree of the forest, grown for its timber, as distinguished from a fruit-tree.

Forge. [Fr.] The furnace in which a smith heats the iron to be hammered. A portable forge is a light and compact blacksmith's forge, with bellows, etc., that may be moved from place to place. In large forges steam-hammers are used, and the metal is moved by cranes.

Forget'-me-not. A small plant of the genus *Myosotis*, with blue flowers, used as a sign of friendship and fidelity.

For'mic Acid. [L. *formica*, ant.] A sharp acid occurring naturally in ants, nettles, etc., and produced artificially in several ways. It is the first member of the fatty acids in the paraffin series, and is similar in character to acetic acid.



AMERICAN MASTODON, FOSSIL.

Fort. [Fr., from L. *fortis*, strong.] A stronghold. Usually a small fortified place, occupied by troops, and surrounded with a ditch, rampart, and parapet, or with palisades or stockades.

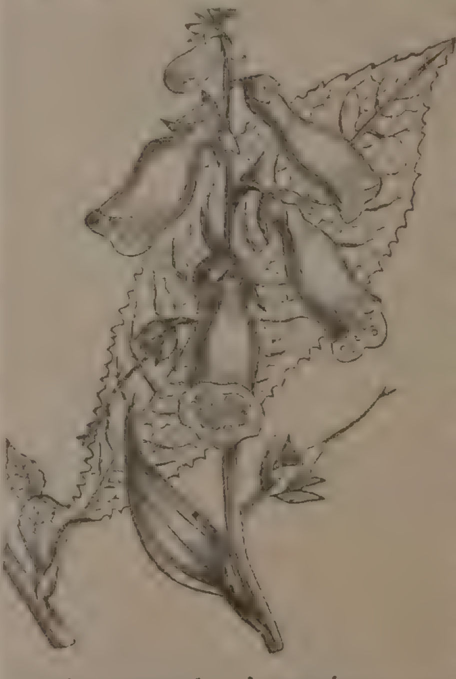
Fos'silized Trees. In many localities collections of tree trunks converted into stone have been found. There are several of these in the United States, there being a remarkable ancient forest in Arizona, whose trees have been converted into opal or agate, with beautifully variegated colors. Some of them are six feet in diameter.

Fos′sils. [Fr., from L. *fossus*, dug.] Hardened remains of animals or plants found in rocks which have been dug out of the earth. Most fossils belong to extinct species, but many of the later ones belong to species still living. The geological strata comprise three main divisions:—the Primary, the Secondary, and the Tertiary; each of these including a number of minor divisions. In the Primary division we find corals, crustaceans, molluscs, fishes, and a few reptiles, and also an abundant flora of herbs and trees of the lower orders, found in the Carboniferous period. The Secondary age had its herbs and plants, its corals, its crustaceans, its molluscs, and its fishes; but the leading animals of this age were its huge reptiles of sea and land. It was peculiarly an age of egg-bearing animals, winged and wingless. The first birds now appeared, with teeth in their jaws, also small marsupial mammals. In the Tertiary period the mammals were wonderfully developed in size and numbers. Its mammoths and its mastodons, its rhinoceri and hippopotami, its enormous dinotherium and colossal megatherium were much larger and more numerous than the largest of existing mammals. The fossil remains of one of its elephants are still so abundant amid the frozen wastes of Siberia, that what have been not inappropriately termed "ivory quarries" have been wrought amid their bones for more than a hundred years. The western section of the United States is exceedingly rich in fossils of the Secondary and Tertiary periods, and new forms are found there annually, some of them of huge dimensions.

Fowl. [AS.] A farm-yard bird used as food, as cock or hen, turkey or duck. Hens feed on grain and seeds, and also worms, flies and beetles. Farm-yard cocks and hens are a mixture of breeds. Game fowls are smaller, and have more delicate legs. Dorkings were first raised at Dorking, England, and are large birds and good layers. Spanish birds are large, with glossy black feathers. Cochin-Chinas are clumsy in shape, and usually reddish-brown, white, gray, or silver gray. Black-breasted Malays and Shanghais are large birds. Hamburgs or grays are silvery white and black speckled. Bantams are very small and courageous. Black and white Houdans are French fowls, and white Leghorns are Italian. The points of a fowl are the neck and saddle hackles, the wing coverts, tail, comb, ear-lobe, wattles, breast, thighs, and legs.

Fox. [AS.] A carnivorous wild animal belonging to the Dog tribe, famous for its cunning. It has a fine coat of reddish-brown fur, low forehead, ears pointed, and wide at the base, and a splendid bushy tail of the same color, tipped, like its breast, with white. The fox is very mischievous, and usually lives in holes on the borders of a farm, which it visits by night. Its food is poultry, game, rabbits, but also frogs, mice, and insects. It is fond of berries and fruits, grapes and honey. Fox-hunting is a popular sport in Britain, fox-hounds being kept to scent and chase the animal, which leaves a strong odor. It tries to deceive the dogs, and passes over a marsh, or through a thicket, or jumps up a fence or tree, to break the scent. The skin of the fox is very useful; that of the Arctic fox being much valued. This animal changes the color of its skin several times during the year, and in winter is white. The skin of the silver or black fox of North America is most valuable. The common foxes of Europe and America are very similar. Fox-brush is the tail of a fox. Fox-terrier is one of a peculiar breed of terriers, used in hunting to drive foxes from their holes. There are rough and smooth haired varieties.

Fox′-glove. [AS.] A large plant with beautiful purple or white bell-like flowers, spotted inside. The common European plant is a handsome perennial or biennial, whose leaves are so useful in medicine, chiefly as a sedative in heart disease.



Franc. [Fr.] A coin used in France worth a little less than 20 cents. It has been used as the unit of French coinage since 1795. It is divided into one hundred centimes.

Freez′ing Mixture. When a substance changes from the solid to the liquid, or from the liquid to the gaseous state, heat is required to effect the change; and when heat is not supplied from without to produce the change, the body itself, and everything in contact with it, becomes colder. This is the principle of freezing mixtures. When ice and salt are mixed, the salt (from its tendency to absorb and dissolve in water) will cause the ice to melt. But ice in melting uses up a large quantity of heat, and the result is (since the heat has in this case been withdrawn from the substances themselves) that the mixture is rendered very cold, and water poured into a test-tube and placed in it will freeze. In practice, freezing mixtures are used for producing artificial ice in moderate quantities, and in freezing creams, etc

Freez′ing-point. That degree of a thermometer at which a fluid begins to freeze. Applied to water, the freezing-point is 32° F. and zero or 0° C. Mercury freezes at 39°F. below zero.

Fret′work. Work adorned with figures cut out by a fine saw. Fillets intersecting each other at right angles are classic designs, and those at oblique angles are often based on Oriental art. Fret-saw or scroll-saw has a long, narrow blade.

Fric′tion. [L.] The rubbing of one body against another. It may be caused by a sliding motion or a rolling motion. Friction clutch or coupling is an engaging or disengaging gear for revolving shafts, pulleys, etc.; they being so pressed together as to revolve in company. Friction-wheel transmits motion by surface friction instead of by teeth.

Frieze. [Fr.] Coarse woolen cloth with a nap on one side, used for outer garments; also the flat band between the cornice and the architrave of a pillar, usually covered with carving.

Frig′ate. A ship of war having two gun-decks, and carrying from 20 to 50 guns; classed between a sloop-of-war and a line-of-battle ship. The term frigate has nearly disappeared, being replaced by *cruiser* in naval terminology.

Frig′ate Bird. [Fr.] A web-footed bird, called also man-of-war bird or frigate-pelican. Its beak and wings are long, and its power of flying very great. It feeds on fish, which it takes from gulls, terns, and other birds.

Fringe. [Fr.] A border or edge of loose threads of wool, silk, or linen; originally consisting of the ends of the warp projecting beyond the woven fabric, but now made separately and sewed on.

Frog. [AS.] A small vertebrate animal, with a broad, squat body without a tail, that lives both on land and water. It has a smooth, slimy skin of a greenish-brown or reddish color; it has teeth on the upper jaw, and by this is distinguished from the toad, which has no teeth. Its tongue is soft and fleshy, and fixed on the front of the mouth, but free behind, so that it can roll out and catch an insect. The tip of the tongue is always covered with a treacly, glutinous matter, to which any insect caught adheres. The frog flings its food down its throat with a very rapid motion. As with the rabbit, its fore limbs are less used than the hind limbs, and so are shorter and smaller. The hind legs are long, and support the swimming web. It has four fingers in front and five toes behind. Frogs breathe slowly, and their blood is of a low temperature. The food of frogs is insects, snails, worms, and they swallow their food whole. Frogs cannot breathe in water, and so live much on land; but water is needed to keep their bodies moist. They lay their eggs at the bottom of the water. The eggs are laid in a kind of jelly, which fastens them to a stick or plant in the water. After about a month the eggs hatch, when there appear small tadpoles, with head and tail and a pair of shoulders behind the mouth, and with gills for breathing. As they grow the gills and tails are lost and the frog develops. Of frogs, the tree-frog, the pond-frog, and the bull-frog are the most familiar. Frogs are found all over the world, and are eaten as food in many places.

Frost. [AS.] When the temperature falls below 32° F., all superficial moisture changes into ice, and we have frost. Frost is one of the agents which play an important part in moulding the surface of the land, as it causes rocks to decay, and breaks up the materials of the soil. When rain falls it sinks into the pores of rocks, and soaks into the soil; and this moisture, in changing into ice, expands and pushes the particles of the rocks or of the soil more widely apart. Ten cubic feet of water give 11 cubic feet of ice. When a thaw sets in, the surface of the rock is loosened, and crumbles into soil, or is washed away by rivers to the sea, and the materials of the soil are broken up and rendered more fit to be made use of by plants. Black frost is where the cold turns vegetation black without hoar or white-frost.

Fruit. [Fr., from L. *fructus.*] The matured seed vessel and its contents. Thus the ears are the fruit of the corn plant, nuts are the fruit of the hazel tree, pods the fruit of the bean or pea, and the acorn the fruit of the oak. In the apple, orange, etc., the seeds are imbedded in a soft, juicy, fleshy substance; in dry fruits, such as nuts, the seed or kernel is surrounded by a hard shell; in drupaceous or stone fruit, as peaches, the fruits are stony within and fleshy without. *Small fruits* include currants, gooseberries, raspberries, strawberries, etc.

THE BANANA.

Fun′gus. [L.] An order of soft plants, including truffles, toadstools, and mushrooms. More particularly the growth on an animal or plant caused by decay or disease, as mildew. Some kinds of fungi are used for food. Lichens are now believed to be fungi existing as partners with algæ.

Fur. [Fr.] The fine hairy covering of certain animals found in cold regions. In the hairy covering of the cat two kinds of hair grow—one short, soft, silky, and barbed lengthwise, which is the *fur;* and longer smooth hair, which is called the *overhair.* The best-known fur-bearing animals are the seal, beaver, sable, fox, mink, marten, otter, ermine, and musk-rat. After the skins have been removed from the animals, and before they are cleaned, they are called pelts. Fur forms the chief clothing of the inhabitants of Arctic regions, and in temperate regions is also used for trimmings or for outdoor garments. In seal-skins for ladies' jackets the overhair is usually removed. The furs of the rabbit, hare, and beaver are used to make felt.

Fur′nace. [Fr., from L. *fornax*, oven.] A close fireplace for melting metals, baking bricks, etc. In air or wind furnaces the fire is urged by the natural draught; in a blast-furnace a forcible current of air is thrown into the fire; in a reverberating furnace the flame, in passing to the chimney, is thrown down by a low arched roof on the materials in the furnace.

Fur′niture. [Fr.] Things supplied or needed for any purpose, as sails, tools, and fittings, and more particularly the articles needed to fit a house for being lived in. Certain articles, as kitchen-ranges, cupboards, shelves, and blinds are called fixtures. In printing, the furniture consists of pieces of wood or metal, lower than the type, placed round the pages or form to secure the type in its place.

Fuse or Fusee′. [L. *fusus*, poured.] A tube filled with explosives, used for firing mines, etc. Fusee also means a match for lighting a pipe or cigar.

Fusee′. [L. *fusus*, spindle.] The cone-like wheel in a watch for the chain to be rolled on, in such a manner that the diameter of the wheel at the point where the chain acts may correspond with the degree of tension of the mainspring.

Fu′sel-oil. [Ger.] An acid volatile oil obtained in the manufacture of potato brandy and whiskey. Its chief constituent is amyl alcohol. It has a powerful and suffocating odor, and is supposed to be a product of the fermentation of sugar. It is an undesirable ingredient in alcohol.

G

Gad′fly. [O.E. *gad*, sting.] An insect that deposits its young in the nostrils of sheep; a species infests cattle, depositing its eggs on the skin and causing sores; another kind produces intestinal parasites in horses.

Gai′ter. [Fr.] A covering of cloth or leather for the ankle and the instep, or for the leg from the knee to the instep, fitting down on the boot or shoe.

Gal′axy. The Milky Way, or zone of milky light which is seen in the sky on clear nights, and is made up of millions of stars. The term is also used for any assemblage of splendid things or persons, as a *galaxy* of beauty.

Gale′na [L.], or **Sulphide of Lead,** occurs native, and constitutes the chief ore from which most of the lead of commerce is obtained. (See *Lead.*) It possesses a bright bluish-white metallic lustre. It is sometimes found in Transition rocks, but more frequently in the Secondary rocks, especially in compact limestone. It occurs in beds and veins, and is found in almost every country. It is very abundant in Britain and in the United States. It is prepared artificially by adding sulphuric acid to a soluble lead salt.

Gall. [AS.] A fluid of a greenish-yellow color, and very bitter, found in the gall-bladder beneath the liver, and consisting of bile mixed with the secretion of the mucous membrane of the gall-bladder.

Gall-nuts. Nuts produced by small insects which puncture the bark of the Lusitanian oak in Southern Europe and Western Asia, and lay their eggs in the wounds. They contain much tannin and are used in making tannin, ink, dye, and in medicine. Oak-apples are formed on other oaks in the same way.

Gal′lon. [Fr.] The standard unit of cubic measurement. The British gallon contains 277.274 cubic inches, and a gallon of distilled water weighs 10 lbs. (avoir.). The gallon of the United States is the standard Winchester wine gallon of 231 cubic inches. The New York State gallon contains 221.184 cubic inches, or 8 pounds of pure water.

Galvan′ic Battery. [Ital., from *Galvani*, the discoverer in 1791.] It consists of a number of zinc and copper plates connected together, their purpose being the production of a current of electricity. These are arranged in cells, the copper-plate of one being joined to the zinc-plate of the next, and the final copper connected by a wire to the zinc of the first cell. The cells contain a dilute acid, which acts chemically on the metals, and generates an electric current which flows around the circuit of cells and wires. The connecting wire may be many miles in length, as in a telegraph line. The zinc of the first cell is called the negative *electrode* and the copper of the last cell the positive *electrode*, the current being supposed to flow from positive to negative. There are many varieties of galvanic batteries in use, and other metals than copper and zinc are employed. Formerly all electric currents were produced by the battery; now it is used only for weak currents, powerful currents being produced by the *dynamo* (*q.v.*) (See *Electricity.*)

Gal′vanized Iron. The name given to sheets of iron which have been coated with zinc. True galvanized iron is first coated with tin by a galvanic process, and afterwards with zinc by immersing it in a bath of melted zinc containing sal ammoniac mixed with mineral matter.

Galvanom′eter. An instrument for measuring the strength of an electric current by means of the deflection which it produces in a magnetized needle. The galvanometer is constructed by using a coil of insulated copper wire, in the centre of which is suspended the magnetized needle. It is frequently named the *multiplier*.

Gamboge′. [*Cambodia*, in Asia.] A reddish-yellow gum used for coloring and in medicine.

It is got from several trees in Siam, Malabar, and Ceylon. It is brought in masses from Cambodia. The best kind is of a dense, compact texture. The gamboge tree of Western India yields, in addition to gamboge, a kind of oil called gamboge butter.

Game. [AS.] Sport of any kind; animals kept or hunted for sport. In Europe game includes grouse, black game, pheasants, partridges, and hares, ptarmigans, quails and larger game as the moose and wild boar. In the United States game includes a great variety of animals. These are rarely kept in enclosures for sport, as in Britain, but they are protected from indiscriminate slaughter by game laws, confining hunters to fixed seasons and means of capture.

Games. [AS., *games*, joy, pleasure.] A term applied to certain physical exercises and mental recreations, distinguished as *games of chance* and *games of skill*. The physical games are such as cricket, football, billiards, golf, etc., the mental are card games, chess, draughts, backgammon, etc.

Gan′grene. A term applied to the first stage of mortification of the flesh. It may result from severe cold, from violent inflammation, erysipelas, and other causes, or may attack open wounds or ulcers. The part attacked loses sensibility and becomes cold and dark in color, while great languor and debility supervene. It may come in old age from a diseased state of the blood-vessels and general weakness.

Gam′ut. [Gk. letter *gamma;* and L. *ut.*] The notes of the musical scale, arranged by Guido d'Arezzo in the tenth century, with *ut* and *gamma* at the ends. The *sol-fa* words were taken by D' Arezzo from the first syllables of six lines of a hymn to St. John the Baptist:

Ut queant laxis
*Re*sonare fibris
*Mi*ra gestorum
*Fa*muli tuorum
*So*lve polluti
*La*bii reatum
Sancte Joannes.

Gan′net. [AS.] A web-footed sea-bird, found in Europe and America, and also called the solan goose. It is a bird of passage, and is very strong on the wing. The gannet follows shoals of herring, on which it feasts. Its skin, feathers, and eggs are much valued.

Gar′bage. Kitchen refuse. In small towns and rural districts this is fed to swine, but in large cities it is difficult to dispose of. In Philadelphia and some other cities it is burned in close furnaces. In others it is utilized in various ways. Thus in St. Louis the oil and grease are removed by the use of naphtha, and employed in soap making. From the remainder a good fertilizer is made.

Gar′goyle. [Fr.] A projecting spout for carrying off water, often cut grotesquely into human and other figures.

Gar′lic. [AS.] A bulbous plant with a strong smell and spear-shaped leaves, used as seasoning. Each root is composed of several smaller bulbs, *cloves of garlic*, enclosed in a common membranous coat.

Gar′net. [Fr.] The name of a mineral species which includes numerous varieties, differing in composition, color, and fusibility. It is hard, brittle, and more or less transparent. The red variety is the most common, but brown, and sometimes green, yellow, and black sorts are found. The variety which includes the *precious* garnet consists of silicate of alumina together with oxide of iron. It is transparent, and of a deep-red color, and is much prized as a gem.

Gar′ter. The band to prevent the stocking from slipping down; the badge of the highest order of knighthood in Britain, instituted by Edward III.

Gas. [Du.] Matter is capable of existing in the three forms known as *solid*, *liquid*, and *gaseous*. The gaseous condition of matter is defined as that which is capable of unlimited expansion—that is to say, that a very small quantity of any gas, if introduced into a large empty space, will always expand so as to fill the entire space. A gas may therefore be defined as matter in the gaseous state. An important property of gases is that they may be liquefied, and all gases, even the volatile hydrogen, have been reduced to the liquid state, and many of them to the solid. *Illuminating gas* is an inflammable gas produced by distillation from coal, petroleum, or other carbonaceous material. It is very largely used in cities for lighting and heating purposes, being conveyed in pipes from a central generating station, carried into houses, and burned at a small opening in a *gas burner*. *Natural gas* arises from wells in the earth in petroleum districts, and is similarly burned for house lighting, heating, and manufacturing purposes. Gas was first used for lighting in England about 1800, in the United States, at Boston, in 1822; New York in 1827, and Philadelphia in 1835.

Gas-engine. An engine in which the piston is worked by the alternate admission and condensation of gas in the cylinder. When a mixture of coal-gas and common air or of oxygen and hydrogen is used, condensation is produced by an explosion caused by an electric spark or a gas jet.

Gas-meters. As coal-gas enters each house it is made to pass through an iron box called a gas-meter. Within this box are wheels, which are turned by the gas; and connected with the wheels, but on the outside of the box, are three dials, on which is recorded the number of cubic feet of gas entering the house in any given time. The figures on the left-hand dial stand for hundreds of thousands, those on the middle dial for tens of thousands, and those on the right-hand dial for thousands of cubic feet. To read the index, put down the figure next behind the pointer on each dial, and add two ciphers. In this way, if the index is found to record 16,700 cubic feet of gas, and at the next examination it records 18,300 cubic feet; then by subtracting we find that 1,600 cubic feet of gas has passed through the meter in the interval.—*Gasometer*, a large tank for holding gas.

Gas'tric Juice. The thin watery fluid, with an acid reaction, secreted by a set of glands in the mucous membrane of the stomach. It is the most important digestive fluid in the body.

Gauge. [Fr.] A class of measuring instruments, whereof each has a specific name to indicate the kind of measurement for which it is to be used. Instruments of this nature are used for a variety of purposes, such as finding the capacity of a vessel (as in gauging a barrel), or in ascertaining the pressure of steam or the force of the wind or the amount of rainfall.

The standard gauge, or distance between the rails, in railways is 4 feet 8½ inches. Broad gauge is 7 feet in England and 6 feet in the United States. Any gauge less than standard is called narrow gauge.

Gauze. [Fr.] A fine, thin silk cloth first brought from Gaza; cloth of linen, cotton, fine wire, or thin fabric like silk gauze. There is a flannel called gauze flannel.

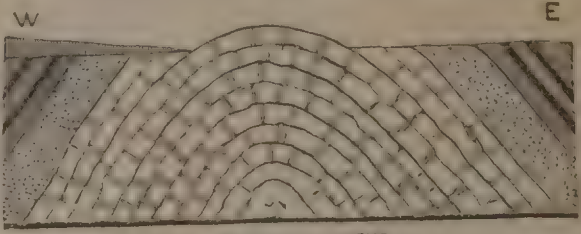
Gazelle'. [Fr., from Arab.] A small, beautiful and graceful kind of antelope found chiefly in Arabia and Syria, also in Africa, with black, incurved lyre-shaped horns, and soft eyes. They roam in herds, and are the prey of the lion and the panther. When attacked they arrange themselves in a circle and present their horns like the bayonets of a regiment of soldiers.

Geiss'ler's Tube. A glass tube in which an almost perfect vacuum is produced, and through which an electrical current is sent. In passing through the vacuum it yields a soft light. These tubes, as modified by Sir William Crookes, yield the light from which the Röntgen ray or X-ray is produced.

Gel'atine or **Gelatin.** [Fr., from L. *gelatus*, frozen.] An animal substance of a nitrogenous nature, supposed to be closely connected with the albuminous substances. It does not exist already formed in the animal tissues, but is obtained by the action of boiling water on connective tissues, cartilage, ligaments, and tendons. When its solution in boiling water cools, it forms a tremulous jelly. It is nutritious, and much used in soups and jellies. It dissolves in hot water and in acetic acid, but is insoluble in alcohol. It is largely used in many photographic processes. A powerful explosive known as *explosive gelatine* is made by dissolving 5 parts of gun-cotton in 95 parts of nitro-glycerine gently heated in a water-bath. (See *Isinglass.*)

Gems'bok. A South African antelope with long, sharp and nearly straight horns.

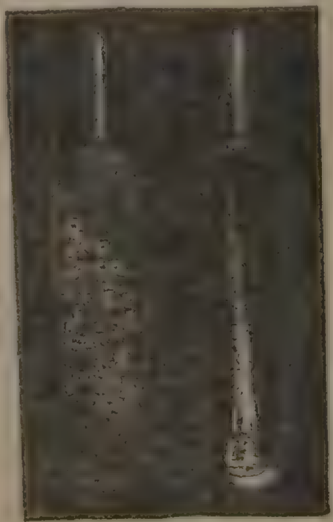
Geol'ogy. [Gk.] The science which treats of the history and structure of the earth. The rocks which compose the crust of the earth have not all been formed in the same way. Some have cooled from a state of fusion, and are known as *igneous rocks*. This class is represented by such rocks as granite, syenite, traps, and lavas. *Metamorphic rocks* are those which have either originally been deposited in water and have become changed into crystalline rock, or those which, originally crystalline, have become foliated in structure under great pressure. *Sedimentary rocks* comprise the various deposits which are laid down on the bed of the sea or on the land. They have all been formed from sediment washed by rain and streams from the land, and, being thus derivative, imply the existence of older rock. This division forms the larger part of the earth's crust, and is the most important for the geologist, since it contains most of the materials from which the geological history of the earth is worked out. These rocks are arranged in *strata* or layers, which have been much lifted, contorted and broken. When they are bent with curve upwards, they are called Anticlinal. They include sandstones, limestones, slates or claystones, etc., their ages depending on their relative position. When the age of a rock strata is in doubt it is frequently learned from the animal or plant fossils it may contain.



ANTICLINAL ROCKS

Gera'nium. [Gk. *geranos*, a crane.] A genus of plants with seed-vessels like a crane's bill. Most of them have showy flowers and a pungent odor. This group includes the commonly cultivated "geraniums" (*Pelargoniums*) which are mostly natives of South Africa.

Germ. [Fr., from L. *germen*, a sprout.] The first form of anything living, from which the egg and the embryo develop. *Disease germs* are minute spores or organisms called bacteria, bacilli, and microbes, which are now known to cause disease. Most forms of microbes are healthful and many of them very useful, the hurtful species being few in number. Dr. Frankland found 20,222 microbes in one cubic centimetre of Thames water, and after filtration 401 in the same quantity of water. In the air after high winds germs are numerous, but after rain their number is small. Bacillus is a long rod form and bacterium a smaller rod form of germ.



Ger'man Silver. An alloy of zinc, nickel, and copper. It is used in the manufacture of numerous articles, such as spoons, forks, jugs, teapots, dish-covers, salvers, etc. The proportion of each

MONEY CENTRES OF THE WORLD

London is the great money centre of the world. Then New York, Berlin, Paris and Vienna form centres in which grea business enterprises originate.—Banks, Clearing Houses and Bourses are the mediums of money exchange.

THE WEALTH OF COMMERCE

A view of shipping in New York Harbor, with the East River Bridge in the background. The vast output of the productions of the farm, the factory and the mill require great fleets of ships to transport them to other countries. They bring in return the wealth of other lands to our shores. This exchange of goods constitutes the wealth of commerce.

ingredient is different in different alloys. Spoons and forks are made from two parts copper, one nickel, one zinc. It is hard, and can take on a bright polish.

Gey′ser. [Icel. *geyser*, from *geysa*, to gush.] The name applied to hot springs, such as were first observed in Iceland, which eject hot water violently either at irregular intervals or periodically. The Great Geyser in Iceland throws up water to a height of from 80 to 120 feet. There are numerous geysers in the Yellowstone region of the United States, some of which throw jets of water to a height of 200 feet. They are also met with in New Zealand and in California.

Gi′la Monster. A large lizard found in the sandy deserts of Texas, New Mexico, and Arizona. It is covered with scales of brilliant orange and jet-black hues, is one of the largest of North American lizards, and has a poisonous bite, its fangs being like those of venemous snakes. Its bite is injurious but rarely fatal to man.

Gill. [Scand.] The opening by which fishes breathe (*q.v.*), and the flap which covers it. Gills are usually thin fringes or plates, through which the blood circulates, and in which it is exposed to the action of the water, from which it absorbs oxygen. The gills of shrimps are the bag-like flaps that hang down where the legs join the body. The gills of an oyster are a delicate transparent frill of four-striped bands.

Gim′let. [Fr.] A small instrument, with a cross handle, grooved body, and a sharp screw at the point, used for boring holes.

Gimp. A kind of trimming used on dresses, curtains, and furniture. It is made of silk, wool, or cotton, stiffened by a fine wire or cord twisted among the threads.

Gin. [Contraction of *juniper*.] A liquid distilled from fermented wort and flavored with juniper berries. Often called hollands because greatly made in Holland. Common gin is flavored with turpentine.

Gin′ger. [Fr., from L. *Zingiber*.] The root-stock of a plant which grows in the East Indies, Africa, and the West Indies. The finest ginger is from Jamaica. Ginger is useful for headaches and asthma, and for flavoring cakes, puddings, ginger-bread, etc. The pale-yellow ginger is the finest; black ginger is of an inferior quality, and is sometimes made into ground ginger. When whitened by chloride of lime, ginger is called bleached ginger. Preserved ginger is the ginger preserved while soft in a thick syrup. It is imported from India and China.

Gin′ger-bread. Sweet bread seasoned with ginger. There is a palm in Egypt called the ginger-bread tree, because its bark looks like ginger-bread.

Ging′ham. [Fr.] A kind of cotton cloth made in Guingamp, in Brittany. Some ginghams are of one color, but others are woven in stripes or checks. The origin of *gingham* is also given as from a Javanese word, and the cloth so called is said to have been first made in India.

Giraffe′. [Fr., from Arab.] A ruminant animal with permanent horns in both sexes, and distinguished by the length of its legs and the remarkable length of its neck. It has points of affinity with the deer, the antelope, and the camel, and others peculiar to itself. It is the tallest animal in existence, measuring in some cases from 18 to 20 feet from the top of its head to the ground. Its home is in the woods of South Africa. Leaves of acacia trees are its chief food. It also eats green herbs, but to do this it stretches out its fore feet and bends its neck to collect the grass. Its eye is very beautiful and large, and shaded with long eyelashes. Its enemy is the lion, which watches for it when drinking on the margin of rivers and pools. It fights by kicking with its hind legs, delivering blows with great rapidity, and often wounding and driving off the lion. It is not easily overtaken even by a fast horse. It is also known as the *Camelopard*, (from Gr. *kamelos*, camel; and *pardalis*, leopard.)

Gir′der. [AS.] A strong beam in a building, supported at both ends, for binding the others together. *Half-lattice girder*, a girder consisting of horizontal upper and lower bars connected by a series of diagonal bars sloping alternately in opposite directions, so as to divide the space between the bars into a series of triangles.

Gir′dle. A narrow band of cloth or leather for the waist. *Venus girdle* is a long, flat, ribbon-like, transparent, comb-like marine animal which lives in the open sea.

Giz′zard. [Fr.] A bird's stomach. A hen swallows food without chewing, which is at once stored in the crop, where it remains till it is softened. The food then passes into the gizzard, where it is rubbed and ground between tough, hard ribs, like the grooves of a wash-board. To help in this, the gizzard is filled with sharp stones and bits of gravel. These are the hen's teeth,

THE MER-DE-GLACE GLACIER.

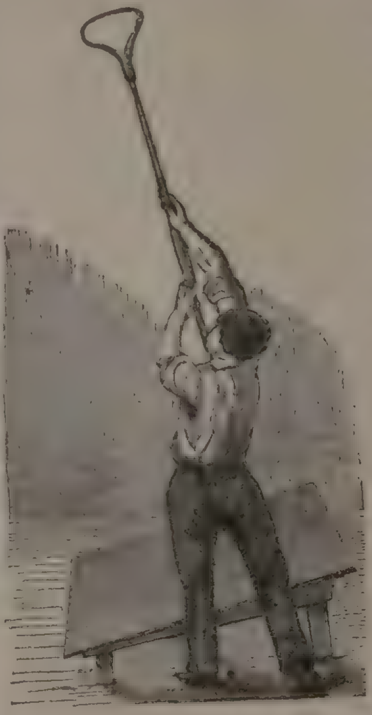
and they do their work while she is gathering food or roosting. The gizzard of the grasshopper has over two hundred teeth or ribs for grinding its food.

Gla'cial Age. A geological period of late date in which low temperature continued for many centuries and vast glaciers made their way downwards from the polar regions into the temperate zone, leaving their marks in scratched rocks, terminal heaps of stones, and other indications.

Gla'ciers. [Fr., from L., *glacies*, ice.] Slow-moving rivers of ice, which derive their origin from the snow which falls on the higher slopes of lofty mountains. As the snow accumulates on the steep slopes, it acquires a tendency to descend under the influence of its own weight. In some cases it slides down slowly, and in others it breaks off in large sheets, which rush down rapidly, forming what is known as an *avalanche*. These snows, as they descend, gradually become compacted into ice and form glaciers, which extend along channels in the mountain sides to the valleys below. They are widely distributed, being met with in different parts of the American continent, and in Greenland; in Europe they occur in the Alps, in Norway, and in the Pyrenees; and in Asia in the Himalayas.

Gland. [Fr., from L. *glans*, acorn.] A knot of nerves, blood-vessels, and flesh in the body for drawing off certain substances from the blood. Each of the thousands of pores of the skin is really an outlet of a tube which connects with a sweat-gland absorbing water from the blood. Two oil-glands are attached to each hair, and the natural oil ought to be sufficient for the hair. The oily matter runs out of the skin and mixes with the sweat. The sweat produced by the skin of an ordinary man in twenty-four hours measures a pint and a quarter, and weighs 1½ lb.

Glass. [AS.] A substance composed of a mixture of two silicates—one being a silicate of an alkali metal, and the other a silicate of an alkaline earth. There are four different kinds of glass, each of which possesses special properties suited to the particular purpose for which it is used. 1. Crown glass, sheet glass, and plate glass are each composed of the same materials—namely, silicates of sodium and calcium; but the method of manufacture is different in each case. Crown glass was at one time the only kind used in England for windows, but it has been superseded by sheet glass. For plate glass great care is taken in the selection of the materials, and the proportion of lime used is somewhat less than in the other two kinds. 2. Bohemian glass consists of silicates of potassium and calcium. This glass is very hard and difficult to melt, and is much used for chemical apparatus, or whenever a glass is required which can withstand heat. 3. Flint glass, or crystal, contains silicates of potassium and lead. It is employed for table glass, globes, ornaments, etc. Glass for optical purposes is made both of flint and crown glass. 4. Bottle glass is an impure mixture of various silicates, such as sodium, calcium, iron, and aluminium. In this variety the color and quality of the glass are not of the same importance as in the other three kinds. In glass manufacture the materials are melted together in a highly heated crucible. A portion of the melted mixture is then taken up by the glass-blower on the end of a long tube, and blown by him into a hollow pear-shaped bulb. It is then given the desired shape by various processes of handling. Many articles of glass are formed in moulds, and other methods of manufacture are employed. The grinding and cutting of glass are subsequent processes for the purpose of ornamentation.



Glass-sponge. A sponge which forms a framework of spicules of silica, which, when the fleshy parts are washed away, looks like the finest spun glass. One species is the handsome Venus flower-basket, another is the Japanese glass rope sponge.

Globe. [Fr., from L. *globus*, ball.] A round body imitating the earth and made of some light material. At two opposite points are fixed two pins, round which it turns; these are called the poles. The two pins produced through the centre represent the axis of the globe. The pins turn in two holes made in a brass circle surrounding the globe, called the *brass meridian*. Round the middle of the globe, at an equal distance from the poles, a circle is drawn, and divided into 360°, called the *equator*. Another great circle drawn round the globe, and inclined to the equator at an angle of 23½°, is called the *ecliptic*. It indicates the sun's line of apparent annual motion.

Glove. [AS.] A covering for the hand, with a separate place for each finger. Gloves are made of worsted, cotton, silk, or of different skins. The finest kid gloves are made from skins of kids, but coarser kinds are made from lamb, rat, and other thin skins. They are prepared and dyed, and punched into different shapes for the different pieces of the glove. The two edges to be sewn are placed in a vice having fine teeth like a comb. They are then damped and pressed.

Glow-worm. [AS.] An insect that gives out light in the dark. The female is without wings, and emits the light to attract the male, which is winged. To keep the light bright, this insect has a brush attached to its tail, with which it keeps its back clean. The light is emitted from segments of the abdomen.

Glu′cose. [Gk. *glykys*, sweet] or **Grape Sugar.** A kind of sugar found in grapes, less sweet than cane sugar. In the United States it is chiefly prepared from corn starch, where the syrup is known commercially as *glucose*, and the solid product from the same source as *starch sugar*. In Europe it is made from potatoes. Glucose is used chiefly in the preparation of table syrups and confectionery, in brewing, in the preparation of artificial honey, and as food for bees.

Glue. [Fr., from L. *gluten*, glue.] A sticky animal substance or kind of impure gelatine, hard, and of a bright brown color. When melted it is adhesive and tenacious. It is made from the horns, hoofs, and sinews of various animals, or from scrapings and cuttings of their skins. These are cleansed, boiled, strained, boiled again, poured into layers or cut into squares and dried. Glue is very useful to the joiner and cabinet-maker.

Glu′ten. [L.] A mixture of various vegetable albuminous substances found in the flour of wheat and other grains. It is a very tenacious substance, and contributes much to the nutritive properties of flour.

Gly′cerine. [Gk. *glykys*, sweet.] A colorless, inodorous, syrupy liquid, having a very sweet taste, soluble in water and alcohol, but insoluble in ether and chloroform. It is obtained from fats. It has numerous uses both in the arts and in medicine. It is used in calico-printing, in perfumery, in leather-making, and in the manufacture of copying ink. When added to water, it lowers the freezing point, and has in this way been serviceable in preventing the freezing of the water in gas-meters. In medicine it is applied externally for softening the skin, and it may be used as a substitute for cod-liver oil. Dissolved in a mixture of nitric and sulphuric acids, it yields the powerful explosive called nitro-glycerine (*q.v.*)

Gnat. [AS.] A small insect with a sting; a blood-sucking fly which undergoes changes of form in water. The females have a needle-shaped proboscis for penetrating the skin of plants and animals. The mosquito is a gnat which injects poison into the wound it makes, and is very annoying in many localities.

Gneiss. [Ger.] The name of a species of rock closely resembling granite. Like granite, it is composed of *mica*, *quartz*, and *feldspar*, but in separate layers. Its texture varies from a fine-grained rock up to a coarse crystalline.

Gnu. A singular kind of antelope, sometimes called the horned horse, and found in South Africa. It is about the size of a half-grown colt. It has short brown hair and a white tail, and a mane on its neck. It has low bent horns and cloven feet, which have all the lightness of those of the stag. Its flesh is like venison, and is much esteemed.

Goat. [AS.] A hoofed animal, closely related to the sheep, and found either wild or tame in almost every part of the world. It is easily tamed, and is a hardy, healthy animal. Its horns curve outward, its chin is bearded, its covering is of hair rather than wool, and its tail is short. It thrives on scanty pasture, where a sheep could not find support. Goats roam on hills, and in many countries are very numerous. Large flocks may be seen on the mountains of France, Switzerland, and Italy. The skin of the goat makes excellent leather; that of the young goat or kid is used for gloves. Goat-skin also makes morocco leather. The fleece yields two kinds of hair, long and short. Ropes and lawyers' wigs are made of goats' hair. The hair of Cashmere goats is woven into fine shawls. The Angora goat resembles the Cashmere, and its hair is used in making zephyr cloth.

Gold. [AS.] A precious metal, one of the metallic elements. It is distinguished by its bright-yellow color, its great ductility and malleability. It is nearly as soft as lead. It has always been highly prized for its beauty of color and lustre, and its power of resisting oxidation (not tarnishing in the air), and for the ease with which it can be worked into artistic and ornamental articles. Its scarcity has led to its adoption as a convenient medium of exchange. Gold is always found in the metallic state. It occurs in grains and strings, and occasionally in lumps or nuggets, and is found dispersed through the gravel deposits in districts where gold-bearing quartz veins traverse the solid rocks. In order to obtain the gold from the gravel or *placer* deposits, the sand containing the metal is washed in an apparatus called a *cradle;* by this means the lighter materials are washed away, and the gold being heavy, sinks to the bottom. Much gold is also obtained from quartz veins in the rocks, by costly processes of mining and extraction. Gold is found in nearly all countries. It occurs abundantly in Australia, North America, and Africa. Very rich deposits were discovered in Australia and California about fifty years ago, and in South Africa at a much later date. Much gold is now obtained in Alaska.

Gold′finch. A beautiful song-bird of Europe, with gold-colored wings, and known as the yellow-bird. It has a black cap and wings, and is some times called American canary. (See *Finch.*)

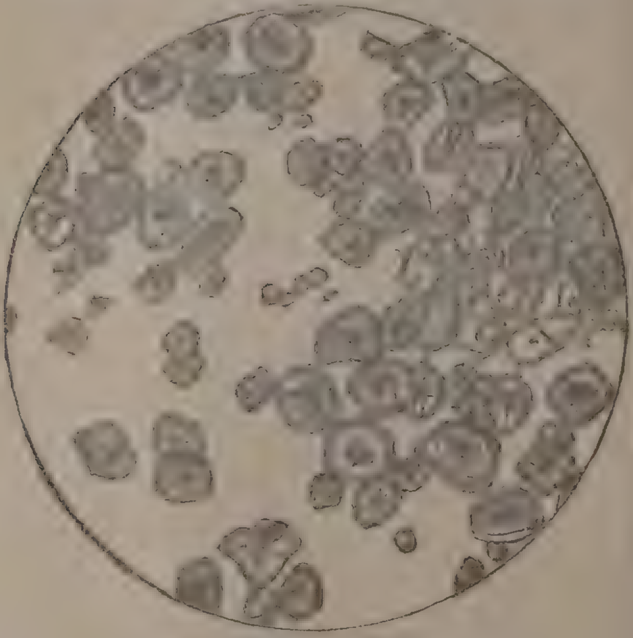
Gold-fish. A small domesticated fish of reddish-golden color, kept in ponds or in glass jars. It is a native of China, and was introduced into Europe in 1691. Many varieties are known. A monstrous variety of gold-fish, with protuberant eyes, is called the telescope fish.

Gold-leaf. This is gold hammered until it forms a very thin leaf. It can be beaten so thin that it would take a pile of 200,000 leaves to make an inch in height. It is used for gilding, by spreading it on wood and other substances. Leaves not so fine are used by dentists for filling teeth.

Golf. [Du.] A game played with a variety of clubs and a ball, the object being to drive the ball into each of a number of holes (usually nine or eighteen) with the fewest strokes of the club. It is a Scotch game, which has of late years become very popular in the United States.

Gong. [Malay.] A round piece of bronze, with a rim round the edge, giving a loud sound when struck. Gong-metal is 78 parts of copper and 22 of tin.

Goose. [AS.] A swimming-bird of the same family as the swan and duck. It is common in most parts of the world. The gander is usually white and the female gray. The goose is larger than the duck. It feeds chiefly on rushes and insects. The common European goose is supposed to have been derived from the graylag goose. The bean goose, the American wild goose, and the Arctic goose are the best known kinds. The Cape Barren goose of Australia, though web-footed, never swims, but is a grazing-bird. Wild geese are of a grayish-brown color, and migrate from the tropics to northern regions and the reverse. They fly in two lines like the sides of a triangle, in flocks of from ten to one hundred. They nest in swamp grass, and, though undisturbed by natural sounds, are quickly on the alert on the approach of the hunter.



CORNSTARCH CORPUSCLES
Seen under the Microscope

Goose'berry. [Fr. *grose*, meaning curled or hairy.] A fruit or berry, often rough with hairs, growing on a bush with sharp prickles.

Goril'la. [African.] A remarkable animal; the largest of the ape or monkey tribe. It has immense canine teeth, powerful muscles, and great strength, and does not hesitate to attack the lion, yet it is a vegetarian. It lives in the dense African jungle. It walks in a peculiar way, swinging its body between its long arms. The females and young live much in the trees and the males on the ground. It is very fierce and difficult to capture and tame.

Gos'samer. [O.E., goose summer, or Mary's yarn or threads.] Thin webs or threads of webs floating in the air, specially in fine weather or in the autumn.

Gourd. The family of plants which includes the pumpkin, squash, melon, cucumber, etc. The bottle or calabash gourd, growing wild in Asia and Africa, bears a fruit like a water-bottle, whose rind is very hard when dry. It is used for bottles, dippers, and other purposes.

Gov'ernor. An instrument used to regulate the supply of steam to the cylinder of a steam-engine. It consists of two heavy balls at the end of two rods, whose other ends are jointed to a shaft, turned by a strap from the engine. When the engine moves these balls revolve and separate by centrifugal force, becoming wider apart the faster the engine moves. They act upon a rod which operates the throttle-valve of the engine. When the engine is going too fast this valve is partly closed and the supply of steam reduced, when going too slow it is opened wider and more steam let in. By this means the supply of steam and speed of the engine are kept uniform.

Graft. [Fr.] A bud or branch of one tree put into another, the stock of which is to support and nourish it. There are various kinds of grafting—cleft, rind, saddle, side, skin, splice, root, and tongue.

Grain. [Fr., from L. *granum*.] A single hard seed of corn. The lines of fibres running along the length of a piece of wood. The grain is the unit of the English system of weights. The pound avoirdupois is 7,000 grains; the pound troy is 5,760 grains. A grain is .0048 of a gramme.

Gramme. The weight of one cubic centimetre of distilled water at the temperature of 4° C. (39.2° F.), weighed at Paris. It is the unit of weight in the metric system.

Gram'ophone. A kind of phonograph invented by E. Berliner about 1895. It has a circular plate of metal covered with a thin film of grease, which the tracing point scratches in a sinuous spiral line. The record is then etched into the plate by acids, and is reproduced in the usual manner.

Gran'ite [Ital. from L. *granum*.] A crystalline rock composed of mica, quartz, and feldspar. In granite each of these minerals is in fragments large enough to be recognized by the naked eye. It occurs in large masses, which have been intruded in many other kinds of rock, and also in smaller masses and veins. It belongs to the class of eruptive rocks, or those which have been pushed up from beneath to the surface by the action of heat. It is met with in great abundance both in Europe and America, and is much used in public buildings, in making docks, and in paving streets.

Grape. [Fr. from O. Ger., a hook or cluster.] The berry or fruit of the vine (as one of a cluster). The berries are smooth-skinned, and have a juicy pulp, and are grown for table use and for making wine and raisins. The principal wine-making countries in Europe are France, Spain, Italy, Portugal, and Germany. Much wine is made in the United States. Many grapes are also grown in Greece, Australia, Cape of Good

Hope, and other countries. The grapes of Greece and Asia Minor are made into raisins.

Grape Sugar, (See *Glucose.*)

Graph′ite. Native carbon in six-sided crystals or in granules, with a black color and metallic lustre. It is used for pencils, for crucibles, and as a lubricator.

Graph′ophone. A modification of the phonograph, which uses, instead of tin-foil, a mixture of wax and paraffine spread upon paper. For commercial purposes this instrument may take the place of the stenographer, correspondence being dictated into it and reproduced by the copyist. For entertainment it will yield a great variety of speech, song, and music.

Grass. [A.S.] Herbage; green fodder; the plant which forms the food of cows, horses, and other hoofed animals; also the class of grain plants with narrow leaves and hollow stems, as wheat, oats, barley, rice, etc. A meadow is a field permanently occupied by grass. When the grass is eaten off by animals it is called a pasture, and when allowed to grow and made into hay it is called meadow hay. Bamboos, though high, are also jointed like grasses. Grasses produce flour, meal, starch, sugar, beer, whiskey, paper and everything made from straw.

Grass′hopper. [A.S.] A small insect that hops among and feeds on grass in summer. Most grasshoppers are colored like the leaves and grasses on which they feed. They do not move in flocks, and are more active at night than by day. They cannot walk, but move by leaps. They have large wings, but do not fly far. The males make a shrill sound with their wings. The katydid makes a sound which is sometimes heard a quarter of a mile distant. The eggs of the grasshopper are covered with a thick skin, and lie all winter in water. Turkeys and other fowls devour many grasshoppers.

Grate. [Low L., a framework of bars.] A set of bars within which the fire burns. In ordinary fire-places most of the heat goes up the chimney, and to prevent this the back and sides of the grate are lined with fire-clay or made of fire-bricks, which reflect the heat into the room.

Grav′el. [Fr.] Loose, rounded, water-worn fragments of rock in which the pebbles range in size from a pea to a walnut. When smaller, they form sand; and when larger, shingle. Gravel is formed by the action of rivers and of the sea; and, since the pieces of the harder species of rocks are best able to withstand the action of water, gravel is found to consist chiefly of fragments of quartz and other silicious materials.

Gravita′tion. The name given by Sir Isaac Newton to his law of attraction, by which every atom in the universe attracts every other atom, with a force varying with distance. It is this force which holds the heavenly bodies in their places, causes the planets to revolve round the sun, and makes falling bodies descend to the earth. The force of attraction is called *gravity*. On the earth it causes a body to fall 32.2 feet a second.

Grebe. A crested swimming-bird about the size of a duck. When swimming it steadies its legs at the rear end of its body, and paddles with its lobate toes in the water. Its nest is a light raft, and floats on the lakes and ponds, where the tall rushes and reeds grow. If an enemy discovers the nest, the bird puts one foot out, and, using it as a paddle, guides the nest to safer waters. As soon as the young are hatched the male leads the little ones into the water. When they are tired of swimming they mount upon the backs of the old birds. The mother bird induces them to dive by holding food in her beak, going backwards as they come near, until she gets them to go under the water to catch it.

Grippe. (See *Influenza*).

Grouse. [Fr.] A game-bird that lives among heather on hills. It inhabits Europe, Asia, and North America. It has a plump body, strong, well-feathered legs, and mottled plumage. Among the varieties are the red grouse, the hazel grouse, the ruffed grouse, the pine grouse, and the spruce partridge.

Grub. [AS.] A worm or larva produced from the eggs of moths, beetles, etc. Grubber is a machine or tool for uprooting stumps or breaking roots.

Gua′no. [Span.] The dung of a sea-fowl, used as a manure, because it contains an abundance of the silicious skeletons of animalcules, and is rich in phosphates and ammonia. Guano was first brought to Liverpool in 1839, from the Chincha Islands on the coast of Peru, but is now exhausted there. It is now obtained from the Macabi and the Huanape Islands. Countless numbers of sea-birds have lived on these islands for thousands of years, and as rain seldom falls their excrement has accumulated to a depth of 200 feet. Guano has a pungent smell, due to the ammonia it contains. By adding to the guano some sawdust wetted with sulphuric acid, the ammonia is fixed, so that its loss is prevented. Guano is an excellent manure for wheat, potatoes, and green crops on strong clay soils. In the great bat-caves of San Antonio, Texas, a shaft has been sunk some hundreds of feet back from the mouth, by means of which it is possible to dig out the guano of the bats without disturbing the enormous number of sleeping bats that doze there during the day. The guano of these bats is the finest exported, because never exposed to rains, which wash out much of the virtue of Peruvian guano.

Guil′lemot. [Fr.] One of several northern sea-birds allied to the auk. It has short legs placed far back, and is expert at diving and swimming. The common guillemot or murre is abundant on the northern coasts of Europe and America, and lays one or two eggs on the barren rocks without any nest.

Guil′lotine. [Fr.] An instrument with an upright frame and a heavy axe, used in France for executions; also a paper-cutting machine with descending knife worked by hand or steam.

Guin′ea. [African.] A coin first made in 1663 of gold from Guinea in Africa, worth 21s. No guineas have been coined since 1817.

Guin′ea-fowl or **Guin′ea-hen.** A bird somewhat like a turkey, of a dark-gray color and with white spots. Its neck is long, and its head has a top-knot, and a fleshy horn on each side. It is noisy and quarrelsome in the farm-yard, but its noise protects poultry from the hawk. Its flesh is a delicacy, and its eggs are valued for their richness.

Guin′ea-pig. A small rodent animal from South America, somewhat like a pig, but also like a rabbit. It has short glossy fur, dark brown or white, with black, white, or yellow patches, or tortoise-shell colors. It feeds on vegetables, especially parsley and carrot tops. It is also called cavy, (*L. Cavia.*)

Guitar′. [Fr., from Gk.] A musical instrument with six strings, the three highest of which are of catgut, and the three lowest of silk covered with silver wire.

Gulf Stream. A great ocean current of warm water, which flows in the Atlantic from the equatorial region, through the Gulf of Mexico, and along the eastern coast of the United States at some distance from land. Its waters cross the ocean and reach the shores of Europe, whose climate is made warmer by its heat.

Gull. [Celt.] A web-footed sea-bird. Gulls live upon fish, but many follow ships for long distances to pick up the pieces of food thrown overboard. They also rob weaker birds of their food, and have been known to snatch fish from the beaks of pelicans. They vary in size, some being small like pigeons, others about 17 inches long. The bill is yellow, and the feet and legs of a greenish-white color. The back and wings are gray, but the head, breast, tail, and under part of the body are pure white. The gull lays three eggs of brownish-olive color, nearly as large as those of the common fowl. All gulls have weak feet and three webbed toes. The largest gulls are the burgomaster or glaucus gull, and the skua or Arctic gull, which frequent the Arctic regions. The tern or sea-swallow has long slender wings. The albatross (*q.v.*) is another large gull. The stormy petrel (*q.v.*) is the smallest of web footed birds.

COFFEE ADULTERATED WITH CHICORY, MAGNIFIED.

Gum. [Fr., from Gk. *kommi.*] The sticky or adhesive juice of certain trees or plants. Vegetable resins are insoluble in water, but soluble in spirits. Gum resins are soluble in either water or spirits. Gum copal is a fossil dug out of the ground in various parts of the earth. It is brought in large quantities from the east coast of Africa. It is found in the sandy plains about a foot from the surface, and is derived from trees of recent times, while amber is from forests of a past geological period. Gum arabic is the juice of several acacia trees that grow in Arabia, India, and Africa, and dissolves in water. Dextrin is made from starch by mixing it with nitric acid, and is now used instead of natural gums. It is used in calico-printing and for postage-stamps. The Gum tree of Australia is the eucalyptus (*q.v.*), with rigid leaves turned to the zenith, and secreting resinous gums. Two American trees are known as the sour gum and the sweet gum.

Gun. An instrument made of a hollow tube for firing shots by means of explosives. The word is applied to the ordinary musket and rifle, and also to cannon of all sizes. Guns increased enormously in size during the past century. The heaviest cannon on Nelson's ship, the *Victory*, had a 68-pound ball. Cannons are now made which will send a ball of more than a ton weight.

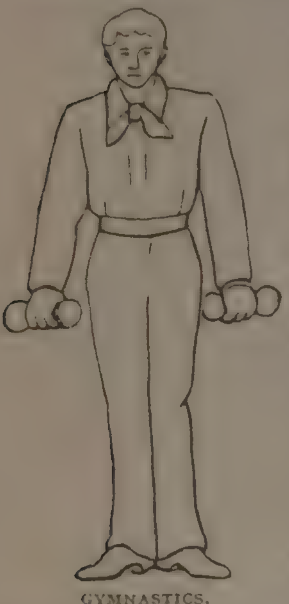
Gun-Cotton. An explosive prepared by steeping cotton-wool in a mixture of equal volumes of strong nitric and sulphuric acids. The cotton, after drying, is not perceptibly altered in appearance, but its weight has increased about 70 per cent., and it has become very inflammable. It is largely used instead of gunpowder, over which it possesses several advantages. The explosive power of one pound of gun-cotton is more than three times that of the same weight of gunpowder. Collodion, used by photographers, is gun-cotton combined with alcohol and ether. Celluloid is gun-cotton combined with camphor and other substances.

Gun-metal. A bronze usually composed of nine parts of copper and one of tin, used for cannon.

Gun′ny. A cloth made of jute fibre. Gunny cloth is a coarse bagging in which pepper, ginger, sugar, etc., are shipped from India. It is also brought to the United States and used to cover cotton bales.

Gun′powder. A well-known explosive, consisting of an intimate mixture of nitre, charcoal and sulphur. In the manufacture of gunpowder the ingredients selected must be perfectly pure, and they must be reduced to powder separately. They are then roughly mixed, sprinkled with water, and formed into a cake, which is afterwards broken up, granulated, and separated into classes by sieves of different sizes of mesh. The violence of the explosive power of the substance is due to the sudden evolution of large quantities of gas. Gunpowder is supposed to have been known to the Chinese before the Christian era, but is believed to have been first used in warfare in the seventh century by the Byzantine emperors in the defence of Constantinople.

Gur′net and **Gur′nard.** [Fr., from L. *grunnire*, to grunt.] A kind of marine fish, supposed to make a grunting noise when taken out of water by the vibration of the muscles of its air-bladder. It has a large and spiny head, with mailed cheeks and large eyes. Some gurnards are highly esteemed for food. The flying gurnard is found in the Atlantic, and is able to fly like the flying-fish. It has large pectoral fins filled with nerves, by the aid of which smaller animals are detected. Thus they serve as food-providers.


GYMNASTICS.

Gus′set. [Fr., from Ital. *guscio*, a husk or pod.] A small piece of cloth let into a garment for strengthening or widening it, especially under the arm-hole of a shirt.

Gut′ta-per′cha. [Malay.] The hardened juice or gum of a tree called percha, common in the Malay Islands. (See *Caoutchouc* and *India Rubber*.)

Gymnastics. [Gr.] A series of exercises arranged according to method for developing and strenghtening the muscles and bodily organs. These include work with dumb-bells, Indian-clubs, wands etc.

Gyp′sum. [Gk. *gypsos*, chalk.] Sulphate of lime a common mineral, of which there are large beds in many parts of the United States. When burned and ground it becomes plaster of Paris. Ground gypsum is often used by farmers as a manure. Alabaster is a fine grained white or light-colored gypsum. Satin spar, a beautiful fibrous variety, is used for necklaces and inlaid work.

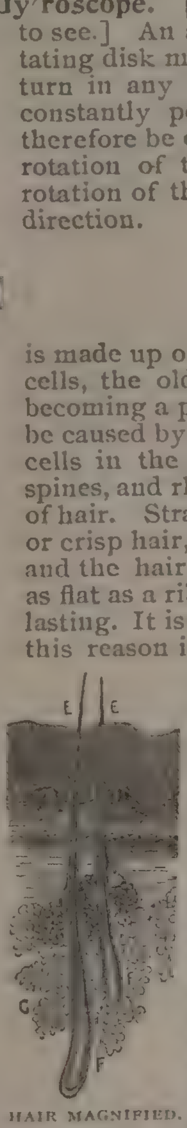
Gy′roscope. [Gk. *gyros*, a circle; and *skopein*, to see.] An apparatus consisting of a heavy rotating disk mounted on gimbals, so that it can turn in any direction. When rotating it will constantly point to the same star, and may therefore be employed to show that the apparent rotation of the heavenly bodies is due to the rotation of the earth on its axis in the opposite direction.

H

Had′dock. (*Gadus æglefinus.*) A food fish of the Cod family, found in large shoals not far from the shore. It weighs from 2 to 4 lbs., and is distinguished by a large black spot on each side, fabled to be the prints of the finger and thumb of St. Peter when he took the tribute-money from its mouth. The haddock is found off the Irish and Scottish coasts, and from New York to the Arctic Circle in the Atlantic. Large quantities are cured in the fishing villages of the east coast of Scotland. The method employed is to cleanse the haddock, steep it for a short time in brine, and smoke it over a wood fire. This was first done in the village of Findon, Kincardineshire, and the fish cured in this way are now known by the name of *Findon* or "Finnan" haddocks.

Hail. [AS. *hagel.*] Frozen water falling from the clouds. There are two kinds of hail, the small grains, which often fall in winter, and generally come before snow; and larger hail, which falls usually in hot weather. The first kind is caused by the freezing of rain-drops as they fall through air colder than that from which they started. How the second kind is formed is not well known. It is supposed to be the result of a tornado whirl in the upper air. Sometimes the particles of hail meeting congeal into large masses called hailstones. These hailstones often do great harm to crops.

Hair. A fine thread-like substance, of various forms and colors, developed from the outer skin of mammals. Each hair consists of a shaft and root. The shaft or part above the skin does not grow, but the bulb or part under the skin, which is made up of little cells, grows by forming new cells, the old ones being pressed forward, and becoming a part of the shaft. Its color is said to be caused by a kind of oil which comes from the cells in the bulb. Porcupine quills, hedgehog spines, and rhinoceros horn are all developments of hair. Straight hair is nearly round, but curly or crisp hair, like that of the negro, is flattened, and the hair of the Bushman in Africa is nearly as flat as a ribbon. Hair is very strong and very lasting. It is also very elastic or springy, and for this reason is much used for stuffing cushions, mattresses, sofas, etc. Horse hair is used for making hair-cloth and other purposes, and the hair of cows, camels, goats, and dogs is used for weaving, and the hair and fur of beavers, rabbits, and other small animals for making felt. Hogs' hair and bristles are largely used in brush-making. Human hair is used chiefly for making wigs, curls, etc. Most of it comes from France, Italy, Germany, Russia, and South America. Young peasant women sell their hair to wandering dealers, who go round to collect it. These sell it to hair-merchants, who partly dress it, and sell it again to the wig-makers. Human hair is also plaited into ornamental work, such as chains, brooches, and pictures and this has in some countries become a kind of art.



HAIR MAGNIFIED.
E, Shaft; F. Root; G, Fat-Cells.

Hal′ibut. [O.E. *Hali*, holy; and *butte*, flounder.] A large, flat sea-fish eaten on holidays. It weighs from 100 to 400 lbs., and is caught by hook and line from Spitzbergen to Iceland, and from Finland and Scandinavia to the British and French coasts, and along the Atlantic coast from New York northwards. The bait used is small herring.

Hallow-even or **Hallowe'en′.** This is the evening of the 31st of October, so called as being the eve of All-Hallows, or festival of All-Saints, which falls on the 1st of November. It is a night on which spirits, good and evil, are supposed to be abroad and witches to hold high holiday. Then nuts and apples are in great demand, and are used for the purpose of foretelling future events in love affairs. In the north of England Hallowe'en is known as Nutcrack Night.

Ha′lo. [Gk. *halos*, a round threshing-floor.] A white or colored circle of light round the sun or moon. These circles are due to the presence of ice crystals in the air. In paintings, the heads of holy persons are sometimes surrounded by a ring called a halo.

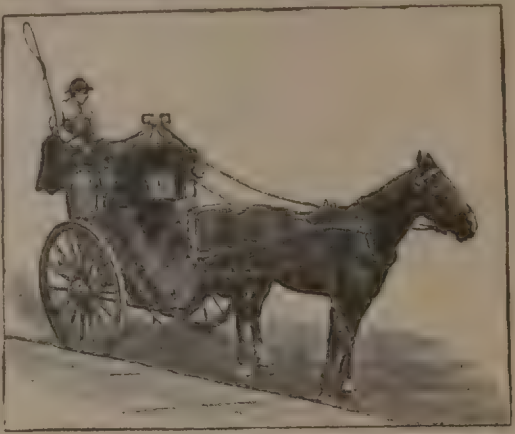
Ham′mer. [Sax. *hamer.*] A well-known tool used for driving nails, beating metals, etc. Hammers are of various sorts, but nearly all consist of an iron head fixed crosswise to a handle of wood. Almost every kind of trade has a hammer of its own. *Power hammers* are those which are worked by machinery. Among them are forge-hammers, used for hammering into shape heavy masses of red-hot iron; and tilt-hammers, used for lighter work, such as forging bars of steel. The steam forge-hammer was invented by James Nasmyth in 1839.

Ham′mock. [Span. *hamaca.*] A kind of hanging bed, chiefly used by sailors. It consists of a piece of hempen cloth or of strong netting, 6 feet long, and 4 feet wide, gathered together at each end and hung to hooks under the deck. Hammocks of netting are often swung from trees in gardens as a pleasant place for resting in fine weather.

Hand.. The extremity of the arm, consisting of the palm and fingers, connected with the arm at the wrist. In all there are 27 bones in the hand. Eight of these are carpal bones, and form the wrist; 5 are meta-carpal bones, found in the palm; and 14 are phalanges—2 in the thumb and 3 in each of the fingers. The hand is the organ of touch, and there is no part of the body where the sense of touch is so acute as at the tips of the fingers. The activity and pliancy of the movements of the hands are remarkably displayed in the playing of the pianist and violinist. A skillful pianist produces about 960 notes a minute in quick time; and this gives a fair idea of the rapidity of movement which can be attained by the hand.

Han′dicapping. A term used in various sports and games to indicate the position of competitors, so that all shall have as nearly as possible an equal chance of winning. In horse-racing, weights are put upon horses not less than three years of age in proportion to their recorded performances. In foot-racing, cycling contests, etc., competitors are started at different distances in proportion to previous performances. In chess and draughts, certain "men" are given up by the better player; and so on in other cases.

Hang′ing Garden. A series of magnificent gardens laid out on elevated terraces at Babylon. They were said to be 400 feet square, thus containing nearly four acres, and over 300 feet high. Water was forced up from the Euphrates to cool the air, water the soil, and supply the fountains.



HANSOM.

Hansom. A low two wheeled cab closed in front by a lid-like apron and having a driver's seat perched back of the top. It is drawn by one horse and used extensively in large cities to convey passengers from one point to another.

Har′bor. [Sax. *here-berga.*] A port or haven for ships. A general name given to any bay or inlet affording ships protection from the wind and sea. Some of these are natural, but many are constructed by breakwaters. In connection with harbors artificial docks are constructed, in which the water is kept nearly at the same level, which gives facility in loading and unloading.

Hard′pan. A stratum of hardened clay, sand, or gravel, from one to three feet under the soft soil, which it serves as a foundation.

Hare. (*Lepus.*) [Sax. *hara.*] A well-known animal, with long ears, a short tail, soft hair, and a divided upper lip. Hares are found almost all over the world. They differ from rabbits chiefly in their habits. Rabbits live together in burrows dug under the ground; but hares live separately, each one making a nest of grass for itself. They pass the greater part of the day in sleep, and in the evening creep out to feed. Green vegetables and root crops are their chief food. Hares are very timid, and move swiftly by leaps. They afford fine sport to the hunter, and in some countries are hunted with hounds. Their flesh is very good, and is much used for making soup.

Har′lequin. The name of one of the characters in a pantomime; of Italian origin. The harlequin is the trickster and the wit of the play, and commits all sorts of knavish acts.

Harmo′nium. A musical keyed instrument in which the tones are produced by forcing air by means of a bellows so as to cause the vibration of free metallic reeds. The first instrument of a really useful kind was the invention of Debain of Paris, in the year 1840. This instrument has now become one of the most common for use in homes, schools, and places of worship.

Har′ness. [Fr. *harnois.*] The trappings of a draught-horse, whether for a wagon, coach, gig, etc. It may be said to consist of four parts: (1) the driving part, or bridle and reins; (2) the drawing part, consisting of the collar, hames, and traces; (3) the supporting part, for holding up the shafts, made up of the saddle and its parts; and (4) the holding-back part, or breeching.

Harp. [Sax. *hearpa.*] A musical stringed instrument. It was very much esteemed by the ancients, and is pictured on the Egyptian monuments. The modern harp is in form nearly triangular, and the wires stretch from the upper part to one of the sides. It stands erect, and is played with both hands by pulling the strings with the fingers and thumbs. The harp is now sometimes used in an orchestra.

Harpoon′. [Fr. *harpon.*] A spear or javelin used for the capture of whales and other large fish. It is made of iron, about 5 feet long, with a sharp flat point with barbs. The edges of the point are made sharp, so that it will go into the whale easily, and then the barbs keep it from pulling out. It is thrown by the hand, but sometimes is discharged from a gun. The *gun-harpoon* is a short bar of iron, with a ring at the end to fasten a rope to. This is fired from a small cannon in the bow of the boat.

Har′row. [Sw. *harf.*] An implement of agriculture chiefly used for breaking up lumps of earth and smoothing ploughed land, and for covering the seeds previously sown. It consists of a frame of varied form, now chiefly made of iron, in which are fixed rows of iron spikes.

Hat. [Sax. *hæt.*] The principal outdoor covering for the head. Hats are chiefly made of felt, silk, or straw. For felt hats the fur of rabbits and hares is used, and for commoner kinds sheep's wool. Silk hats are made of two or three layers of calico saturated with varnishes, moulded into shape on wooden blocks, and covered with fine silk plush. In the manufacture of straw hats the straw commonly used is that of wheat or barley.

Hawk. [Sax. *hafoc.*] A name common to many species of birds of prey belonging to the Falcon family. Hawks differ from true falcons by having shorter wings and an unnotched bill. (See *Sparrow Hawk.*)

Hawk′ing. The art of training and flying hawks, to capture other birds. This practice, called *falconry*, is of high antiquity, and in old times was a favorite amusement with the rich, and to some extent with the poor. It has now gone out of use.

Haw′thorn. [Sax. *hægthorn.*] A shrub or small tree which bears the *haw.* It is a native of Europe, Siberia, and the north of Africa. In Britain it is largely planted both for hedges and for ornament.

Hay. [Sax. *heg, hig.*] The stems and leaves of grasses cut and dried for fodder. After being mown, the grass is shaken up and spread abroad evenly over the ground, to be dried by the sun. This is continued for several days, the hay being raked into windrows at night and into small heaps if rain threatens.

Hay Fever. A warm weather disease; its symptoms are those of common catarrh, yet very difficult to cure, and recurring annually at a fixed time. It is thought to be due to the pollen of certain plants. Some persons are very susceptible, but most people not at all so.

HAWK.

Ha′zel. [Sax. *hæsel.*] A genus of nut-bearing plants or small trees of the order Coryleæ. The hazel is a native of all the temperate parts of Europe and Asia. It is also common in North America. In England the hazel is cultivated for its nuts (*filberts*), from which, on pressure, a valuable oil is obtained. The wood of the hazel is largely used—the smaller kind for making crates, baskets, hoops, whip-handles, etc.; and the larger wood for charcoal, which is in great demand for forges, for the manufacture of gunpowder and of artists' crayons.

Heart. [Sax. *heort.*] A hollow muscular organ, with four chambers, in the higher animals. It is the centre of the blood's motion in an animal body, and is situated in the thorax. The blood flows from the veins to the two right chambers of the heart (auricle and ventricle), then to the lungs, next to the two left chambers, from which it is driven into the arteries. Thus the circulation is carried on and life maintained. The heart of a reptile has only three chambers, and of a fish only two, so that the blood is imperfectly aerated, and there is little animal heat.

Heat. A force in nature known by its effects in fusion and evaporation. Formerly it was supposed to be a subtle fluid, which was known as caloric. It is now regarded as a kind of motion, being in general a form of vibration or disturbance of molecules. One of the most important effects of heat is to alter the temperature of bodies. A piece of iron put into burning coals becomes hot, because the heat passes from the coals into the iron, until both have reached the same temperature. Heat also alters the dimensions of bodies. For example, the tire of a wheel is made a little too small, and when heated it enlarges so as to slip on easily. It cools down to the same size as it was at first, and then fits so tightly that it binds all parts of the wheel firmly together. The ends of rails are always left a little way apart on railroads; for if rails were laid close together the heat of the sun might expand them, and push them out of place. Heat is communicated to different bodies in at least three distinct ways. First, by convection, as when water is heated in a kettle (over the fire). Second, by conduction—that is heat traveling from one end of a substance to the other end. Hence we have good and bad conductors of heat. Metals are good conductors, glass is a bad conductor, and wood is a still worse one. This is the reason why iron tools for heating in fires have wooden handles fitted to them. A third way is called radiation. This may be best illustrated by placing some substance near a fire. The heat passes over to it or is radiated to it from the fire.

Heath. [AS. *hœth.*] A genus of narrow-leaved evergreen shrubs of many species (from 400 to 500 are known). Over a dozen inhabit Europe, and have small pink flowers; the remainder are natives of South Africa, many of them bearing brilliantly-colored flowers. *Heather* is a species of heath.

Hedge. [AS. *hege.*] A fence of thorn bushes or other shrubs or small trees planted round a field, or in rows to separate the parts of a garden. Hedges are very common in many parts of Britain and Italy, but comparatively rare in France and Germany, as well as in America. They are usually of one or more of the following species: hawthorn, blackthorn, privet, holly, beech, maple, alder, poplar, willow, yew, sweet-brier, etc.

Hedge′hog. [L. *Erinaceus.*] An insectivorous animal, with the power of rolling itself into a ball, and with its hairs developed into sharp, strong spines. Few animals care to attack it, and those that do are usually driven off by the armor of spines. Fourteen species are found throughout Europe, Africa, and most of Asia. The common hedgehog is about 9 or 10 inches long, the spines on the back measuring about an inch. It is nocturnal in its habits, hibernates, and feeds on insects, mice, and worms. It is useful in a garden, and has been rendered domestic, and used to destroy cockroaches.

Hel′met. [AS. *helan,* to cover.] A head covering formerly largely in use as a defensive armor. It is now chiefly used for ornament, but firemen wear it as a protection from falling materials at fires, and in hot countries helmets of white felt covered with rolls of linen are worn as a protection against the sun's rays.

Hem′atite. An abundant and valuable ore of iron, the sesqui-oxide. Vast quantities of it exist in the United States, especially in Michigan and Missouri. In the latter, two mountains, Pilot Knob and Iron Mountain, consist chiefly of this ore.

Hem′lock. [A S. *hemleac.*] A plant of the genus *Conium*, whose leaves and root are poisonous. The common or spotted hemlock is from 2 to 7 feet in height, and grows by waysides and on heaps of rubbish. It is common in Europe and in some parts of Asia, and is now also a naturalized plant in North America and Chili. A valuable medicine is obtained from the leaves and fruit. *Water hemlock* grows in ditches, on the margins of ponds and on wet-grounds in Europe and the north of Asia. It is a very poisonous plant, and is the cause of many deaths. *Hemlock spruce* is an evergreen cone bearing tree, common in North America. It is a beautiful tree, often growing to the height of 100 feet. The bark is largely used in tanning leather.

Hemp. [AS. *henep.*] A fibrous plant of the genus *Cannabis*. It is cultivated in many parts of the world, but most largely in Poland and in the centre and south of European Russia. Hemp varies from 4 to 12 feet in height. The stem is hollow or filled with pith, and the bark contains a useful fibre, which is extracted and used for making canvas, ropes, sail-cloth, bagging, and other articles. The seed is often used to feed poultry and small birds, and it also yields an oil very good for burning, and also a narcotic resin called *hasheesh.*

Herb. A plant with a soft stalk, and which bears flowers and fruit only once, and then dies. Some live one year only, others two or more years.

Herba′rium. [L. *herba*, a plant.] A collection of specimens of plants, carefully dried and preserved. These collections are very valuable for the scientific study of plants, and there are some in existence which are centuries old.

Her′on. [Fr.] The name of a large tribe of wading birds found in almost every part of the globe. The body is small in proportion to the length of the neck and the legs. The legs are very long and slender, and the bill is longer than the head, and comes to a sharp point. Herons feed mostly on fish, frogs, crabs, and other water animals. These they greedily devour. They build their nests in high trees near the water, and feed their young with fish until they are old enough to care for themselves. The European heron is remarkable for its directly-ascending flight, and was formerly hunted with the larger falcons.

Her′ring. (*Clupea harengus.*) [AS. *hæring*, from the root *here*, an army.] A well-known sea food-fish. Herrings are found on the shores of the North Sea, the North Atlantic, the Baltic, and the White Sea. They approach the coast every spring in order to spawn, and then the great herring-fishing season commences. They move about in immense schools—the main body often divided into columns of from five to six miles in length and from three to four in breadth—swimming near the top of the water, and followed by multitudes of larger fishes and by gulls, fish-hawks, and other sea-birds, which feed on them. Drift-nets are employed in catching herring. These are let out from boats, usually in the evening; and when the fish are taken to the shore they are cleaned, salted, and packed in barrels. The fish locally known as herring in the American rivers south of Maine is the alewife, of the same genus as the shad. It is very abundant and much esteemed. There is also a Pacific herring whose abundance resembles that of the Atlantic species, and whose fishing is of growing importance.

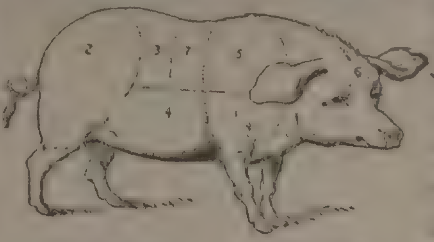
Hick′ory. A tree belonging to the Walnut family, found only in North America. The wood is tough and elastic, and is largely used to make hoops for casks. Handspikes, carriage shafts, wheel spokes, handles of axes and golf clubs, large screws, etc., are made of it. The trunk is slender and has a very rough bark, and the tree grows to a height of from 60 to 100 feet. The *hickory-nut* has a delicious flavor. One southern species yields the esteemed *pecan-nut*, others yield the *pig-nut*, *bitter-nut*, and *mocker-nut*.

Hieroglyph′ics. The name applied to the ancient Egyptian writing, in which the forms of animals and natural objects stand for words, and sometimes for syllables or letters. Chinese writing is similar in character, and all systems of writing are thought to have begun with hieroglyphics.

Hippopotamus. [Gk. *hippos*, a horse; and *potamos*, a river.] A large animal about 12 feet in length and 5 feet high at the shoulders, with short legs and four toes on each foot, a skin on the back and sides more than two inches thick—of dark-brown color and destitute of hair. It is found only in Africa, and lives mostly in lakes and rivers, and can remain a long time under water. At night it comes up on the banks of rivers, and feeds on plants and herbage. It lives in herds of from twenty to forty individuals. The hippopotamus is much hunted by the Africans for its flesh, of which many of them are very fond. The hide is converted into shields, helmets, whips, and canes, and the large canine teeth are much valued for their ivory, and form a very considerable article of African commerce.

Hive. [AS. *hyfe.*] See *Bee.*

Hog. The common name of the animal also called pig, and collectively *swine*. The eyes of the hog are very small and sunken, his nose is mobile, his form without beauty, his motions clumsy, and his appearance slothful and stupid. The hog is highly prized for its flesh, which supplies a chief article of food to many nations in the form of pork, bacon, ham, sausage, etc. Its fat is made into lard, its skin into leather for the saddler and trunk-maker, and its bristles are largely used in the manufacture of brushes. Wild hogs are common in many countries, and are hunted in various places. They are dangerous on account of their expert use of their tusks or long canine teeth. Wart-hogs have large lobes on each side of the face, and remarkably modified teeth. The African river-hog is of a gray color, and the West African red river-hog is remarkable for vivid coloring and long pencilled ears.



1 SHOULDER
2 LEG AND HAM
3 HIND LOIN
4 BRISKET
5 SPARE-RIB
6 HEAD
7 FORE LOIN

Hogs′head. Formerly a measure of capacity in use in England, containing 63 wine gallons and 54 ale gallons. In the United States the measure is still in use, and the term there signifies a large cask containing from 110 to 140 wine gallons.

Hol′ly. [AS.] A shrub or tree with shining, prickly, and smooth and wavy leaves and scarlet berries. The common holly grows in Europe, and in some parts of Asia. It is largely used for hedges, and forms an excellent fence. The American holly is found along the coast of the United States. It grows to be a tree of considerable size. The wood of both kinds is very hard, fine-grained, and almost as white as ivory, and is much used by cabinetmakers, turners, and musical instrument makers. The bark yields a substance from which bird-lime is made, and is used as a febrifuge, while the berries are a violent purgative. Branches of holly are largely used at Christmas for decoration. The Brazilian or Paraguay holly yields leaves from which the *mate* or *Paraguay tea* is made. It is more exciting than ordinary tea, and if taken to excess produces a kind of intoxication.

Holly′hock. [AS. *holihoc.*] A well-known hardy plant, the *Althæa rosea*, cultivated in gardens for its spikes of large and beautiful flowers. It is called also *rose-mallow*.

Hom′iny. [W. Ind.] Maize hulled and crushed; prepared for food by boiling in water.

Hone. [AS. *han.*] A hard stone of very fine grit, used in sharpening knives, razors, and various sharp-edged tools. The best stone for hones is found in Arkansas and Turkey, and when in use is wet with oil. Coarser hones are usually called *whetstones*, and are wet with water.

Hon′ey. [AS. *hunig.*] A very sweet substance collected by honey-bees from the juices in the flowers of plants, and deposited in the cells of the honeycomb. Heather honey is of a rich yellow color. Narbonne honey is white, and is made from rosemary flowers. The fine aroma of Maltese honey is due to orange blossoms. In the United States the finest is from forests of basswood and white-clover pastures; also honey from buckwheat is abundant. Honey is largely used as an article of food, in sweetmeats, in some kinds of ale, and also as a flavoring in medicines. The old intoxicating drink called mead was made from honey.

Hon´eysuckle. A genus of flowering and climbing plants or shrubs, often planted in shrubberies and trained against walls on account of the beauty and delicious fragrance of their flowers.

Hoof. [AS. *hof.*] The horny substance which incases the feet of horses, cows, sheep, etc. Horses' hoofs, which are harder, are made into glue and ground up for artificial manure. Prussiate of potash, used for making Prussian blue for dyeing and calico printing, is made from horses' hoofs. (See *Horn.*)

Hop. [Du. *hop.*] A well-known climbing plant, very extensively cultivated in the south-east of England. It is a native of Europe, and is now grown in the United States and in Australia and New Zealand. It is largely grown in some of the American States, especially in New York. The plant is cultivated for its flowers, which are gathered or picked dried in kilns, bleached with, sulphuric acid, and then used in making beer. They give it a bitter taste, and help to make it bright and clear. *Hop bitters* are used as a tonic.

Hore´hound. [AS. *harhune.*] A small plant with whitish stem and flowers. It has an aromatic smell, and is a popular remedy in cases of coughs and asthma.

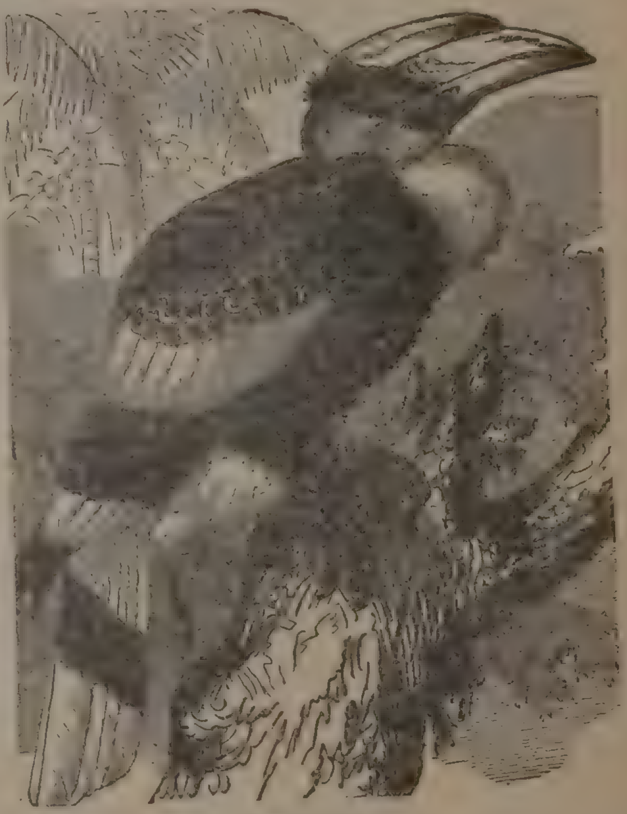
Hori´zon. [Gk. *horizon.*] A circular line touching the earth, and formed by the apparent meeting of the earth and sky. This is called the *visible* or *sensible horizon*, while the great circle parallel to the sensible horizon, and passing through the earth's centre, is the *rational* or *celestial horizon.*

Horn. [AS.] A hard substance, usually of considerable length, growing on the heads of some animals, and also as the hoofs, claws, or nails of animals generally. The horns of the Ox family are never shed; the antler of the deer is bone, and is shed annually. Horn is a tough, flexible, semi-transparent substance, and is softened by heat. It is composed of thickened albumen, with small portions of gelatine and phosphate of lime. Horn when heated may be moulded into almost any shape, which it will keep when cold. The horns of the ox, cow, bison, buffalo, sheep, goat, and antelope are made into many highly ornamental and useful articles—such as handles for knives, forks, umbrellas, and walking-sticks; also into spoons, snuff-boxes, buttons, etc. Combs are made from flattened sheets of horn, which are got after the horn has been steeped in water for a considerable time.

Horn´bill. A bird of ungainly appearance, with large bill, helmet crowned, and found in India and Africa. By curious habit the male bird plasters the female in the hole of a hollow tree during nesting time.

Horn or French Horn. One of the most important of wind musical instruments, much used in orchestral music and in military bands. It gets its name from the first horns having been made of the horns of animals. It produces a soft and peculiar tone, due to the length of the tube, which is coiled up into several rings, and has a large bell-shaped end.

Horn´blende. A tough mineral of black color, due to a large percentage of oxide of iron. It forms part of several rocks, as trap, syenite, and hornblende slate, which is excellent for flagstone purposes.



THE HORNBILL.

Hor´net. An insect belonging to the Wasp family, but much larger and stronger than the ordinary wasp, and whose sting gives severe pain. It is fully an inch in length. It forms its nest of a kind of paper-work made from bits of wood and bark, which it places in hollow trees and walls. It feeds on fruits, honey, and insects. Hornets, like bees, live in societies made up of males, females, and workers. The females and workers do all the work, and sting when disturbed. Their sting inflicts a painful wound, usually accompanied with considerable swelling. The best applications for it are grated potatoes and sweet oil.

Horn´pipe. An instrument of music formerly very common in Wales. It is also the name of a characteristic lively British dance much in favor among sailors.

Horse. [AS. *hors.*] A beautiful animal, useful for carrying loads or drawing wagons. It is a most intelligent animal, knows its master well, and if kindly treated will always do its work willingly and cheerfully. The horse belongs to the genus *Equus*, which contains several species, including the horse, the ass, the quagga, and the zebra. Horses in a wild state are found in many countries, and are very numerous in South America. Almost every country has its own breed of horses, which is generally suited to the climate. The horses of Iceland are small, with thick shaggy hair. The Arabian horse is much larger, and is one of the finest of all breeds. The Barbary horse of Northern Africa is much like the Arabian, but smaller. The British horse, from which the best horses in the United States have come, has much Arabian and Barb blood in it. It resembles the Arabian in appearance, but is much taller and longer. The best trotting-horses are found in the United States and in Canada. Draught horses, or horses used in drawing heavy loads, are reared in many countries. The Percheron breed, common in France, has been noted for hundreds of years. They are large, heavy horses, with large heads, and are much used for drawing business wagons. The principal parts of the body of a horse are—(1) the chest, (2) the withers, (3) the barrel, or part enclosed by the ribs, (4) the flanks, (5) the loins, and (6) the buttocks. The age of a horse may be ascertained from an inspection of its teeth. Horses sometimes live 30 years, but the average age is from 15 to 16 years.

Horse-chest′nut. A large and ornamental tree, with large compound leaves, and bearing white flowers and a fruit or nut with a prickly shell. The nuts have a bitter taste, and are sometimes used as food for cattle. In some countries chestnuts are ground, and mixed with the food of horses; hence the name horse-chestnut. They are also made into a strong paste for bookbinders and shoemakers, and in France and Switzerland they are used in cleaning woolens and in the washing and bleaching of linen. The bark of the tree is sometimes used in tanning leather.

Horse-power or **H.P.** The power of lifting 33,000 lbs. weight one foot high in a minute; it is entitled *indicated* or *nominal*.

Horse-rad′ish. A small plant with a stem about two feet high, but having a deeply-penetrating root, for which it is chiefly cultivated, and from which a highly valuable seasoning, of strongly acrid taste, is obtained.

Horse-shoe. A shoe for horses, consisting of a plate of iron of a circular form. Horse-shoes are necessary as a protection to the foot on stony or hard roads, and they vary in size, shape, and strength according to the formation of the foot and the kind of work the horse has to perform. They were formerly all made by the hand, and many still are, but machinery is now largely employed in their manufacture. Modern farriery requires light, small shoes, with few nails, and that the shoe be put on without overheating, which is cruel, and injures the horn.

Ho′siery. A name given to hose or stockings, and used now to include all kinds of knitted articles. Stocking-knitting was all done by the hand, until William Lee, of Woodbridge, in Nottinghamshire, invented a knitting-frame. Many additions and improvements have since been made, so that now not only stockings and socks but nearly all articles of hosiery are made by a knitting-frame of one kind or other.

Hos′pital. [Fr., from L. *hospitalia*, apartments for strangers.] A building used for the reception of sick persons, or for those who are unable to supply their own wants. Some hospitals are set apart entirely for the treatment of those suffering from disease, others for incurables; some for the education of children, and others as homes for the poor and helpless. Naval and military hospitals are provided in all countries for the care of sailors and soldiers.

Hos′tage. [Fr. *Otage*.] A person left with an enemy or hostile power as a pledge to secure the performance of the articles or conditions of a treaty.

Hot-House. A building warmed by stoves or furnaces for rearing exotics or tender plants. A *hot-bed* is a garden bed covered with glass, to rear plants early in the season by the heat of the sun.

Hound. [AS.] A dog used for hunting. The bloodhound, staghound, and foxhound hunt only by scent, and may be termed true hounds. To this class may be added the harrier and the beagle; but the greyhound and the deerhound run by sight alone, and strictly speaking are not true hounds.

Hour. [Fr., from L. *hora*, an hour.] A space of time equal to 60 minutes, or to 1-24th part of a day. The hours of the civil day begin at midnight. Since 1885 the hours of the astronomical day begin at midnight, and are counted from 0 to 24.

Hour′-glass. A kind of chronometer or instrument for measuring intervals of time. It is constructed of glass, and consists of two bulbs, one above the other, connected by a narrow neck. The time is measured by the running of dry sand from the one bulb to the other, the quantity being adjusted to the time which each glass has been constructed to indicate. In the case of an hour-glass, as much sand is placed in one bulb as will take an hour to pass from it to the other. Hour-glasses were very much in use in churches during the 16th and 17th centuries, and specimens of very fine workmanship are still to be seen in several churches in England. (See *Log*.)

Huck′aback. A kind of linen with raised figures on it, used for table-cloths and towels.

Huck′leberry. A shrub of the Heath family which grows wild over most of the United States, and yields a palatable berry. There are several kinds, some being low bushes, while the swamp blueberry grows several feet high, and bears a much larger berry. The billberry is the same as the blueberry. (See *Whortleberry*.)

Hum′ble-bee. [Ger. *hummel*.] It is often called *bumble-bee*. (See *Bee*.)

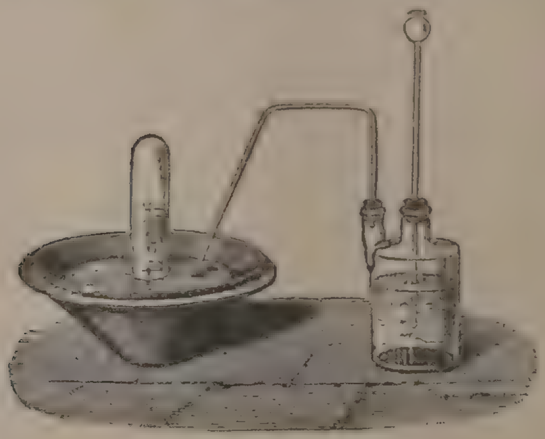
Hum′ming-bird. The smallest and most beautiful of all birds, found only in America, and almost exclusively tropical. They get their name from the peculiar humming noise made by the rapid vibration of their wings. The muscles of their wings are very strong. This enables them to fly with great swiftness, and to hover over a flower while they capture the minute insects in it and perhaps sip the nectareous juices. They do not sing, having only a kind of shrill chirp. Their nests are very pretty, made of mosses and lichens, and lined with cotton and any soft thing they can find. They are unsurpassed by any birds for their brilliant plumage, and some are ornamented with crests, tufts, or frills. Many fruitless attempts have been made to domesticate these beautiful birds.

Hur′dle. [AS. *hyrdel.*] Twigs, osiers, and sticks woven together; a frame of split timber or sticks for gates and fences.

Hy′acinth. [Gk. *hyakinthos*, an iris.] A plant with a large rounded root and a beautiful flower of different colors.

Hydrau′lics. The science of fluids in motion. Of its applications may be named the hydraulic ram, which pumps water by the force derived from a moving stream; the hydraulic or hydrostatic press, in which the pressure of a column of water exerts a powerful force; and the hydraulic engine, which is operated by water pressure.

Hy′drogen. [Gk. *hydor*, water; and the root of *gennao*, to produce.] The lightest of the chemical elements. Hydrogen is a colorless and, when pure, tasteless gas. It is very inflammable, gives little light, but its flame is one of the hottest known. It is never found alone, but is always present in water. Pure hydrogen gas is about 14½ times lighter than atmospheric air. It is generated by pouring dilute sulphuric acid upon zinc and collecting the gas in a receiver over water.



HRDROGEN GENERATOR.

Hydrom′eter. [Gk. *hydor*, water; and *metron*, a measure.] An instrument for measuring the weight of a liquid as compared with an equal amount of water.

Hye′na. [L. *hyena.*] A genus of carniverous quadrupeds, about the size of a large dog, and of fierce and almost untamable character. The back and neck of the hyena are covered with coarse, shaggy hair, forming a sort of mane. The hinder parts are lower than the fore parts, and it has a large head and ears. Hyenas live in caverns and rocky places, and at night prowl about in search of food, which generally consists of dead animals, but when very hungry whatever living prey they can seize. The common or striped hyena is a native of Southern Asia, while the spotted hyena is found in Southern Africa.

THE HYENA.

Hydrop′athy. [Gr. *hydor*, water; and *paskein*, to suffer.] A mode of curing disease by the application of water. This is applied in various forms of the bath, also by enveloping the patient in a wet sheet. It has a bracing and tonic effect upon the system.

Hydropho′bia. [Gr. *hydor*, water; *fobos*, fear.] A disease caused by the bite of a rabid animal, and so called from the great dread which those who suffer from it have of water. Some doctors say that no such disease exists, the symptoms being due to fear and nervous excitement. Pasteur claims that it is a bacterial disease, and can be cured by inoculation with attenuated virus.

Hyp′notism. [Gr. *hypnos*, sleep.] The science of what was once called mesmerism and animal magnetism. The subject in a hypnotic state comes under the sole control of the operator, and acts under his suggestions, which seem reality to the patient. It is said that suggestions to perform a certain act at some future time will be obeyed, and in this way a criminal act might be done for which only the operator was responsible, the patient ceasing to be a free agent. Hypnotic suggestion is now used as a remedial agent, patients being induced to give up drinking, to cease other hurtful practices, to perform useful exercises or become diligent in study, etc. Also painful sensation is obviated, so that surgical operations can be performed without suffering.

I

Ice. [AS. *is*, *isa*.] Water freezes into ice when its temperature falls to the freezing-point, which is 32° on the Fahrenheit thermometer, and zero on the Centigrade. Ice forms on the surface of water, which expands in freezing—that is, any given quantity of water makes a larger volume of ice. The ice is therefore lighter than water, and this is the reason it floats. The expansion of water by freezing produces very remarkable effects on rocks and stones, splitting the rocks open and cracking the stones. Ice is found all the year round in the Polar regions, and on the tops of very high mountains. *Glaciers* are vast bodies of compressed snow and ice which move slowly down mountain sides. *Icebergs* are large masses which break away from glaciers on the Arctic coasts, and, falling into the water, float into warmer seas. Ice is now an important article of commerce, and is shipped in large quantities to warm countries, chiefly from the United States. Norway sends ice to Great Britain. Large quantities of ice are now made by freezing machines, in which cold is produced by chemical action.

Ichneu′mon. An animal of the Civet family, though it closely resembles the weasels in form and habits. It is about 18 inches long and very slender. It feeds on birds, rats, reptiles, etc., and, though destructive to poultry, is valued for its slaughter of snakes, and destruction of their eggs, of which it is very fond. It also digs up and sucks the crocodile's eggs, and on this account the Egyptians places it among their gods. *Ichneumon flies* are a family of insects which deposit their eggs in the bodies of other insects.

Igua′na. A reptile abundant in South America and the West Indies, of about 5 feet in length. It is of a green color with a bright yellow crest along the back. Though formidable in appearance, it is very timid, and is hunted for its delicate flesh, which tastes much like chicken.

In′cense. [L. *incensum*.] The perfume produced by the burning of spices and gums. It is the symbol of prayer in churches. The powder, made up of benzoin, storax, and other resins, cascarilla bark, etc., is placed in a silver vessel hung by chains. As it burns, the smoke escapes through little holes, and fills the church with sweet odors.

Inclined Plane. A sloping surface up which a weight can be pushed or rolled that could not be easily lifted. It is believed that the pyramids of Egypt were built by the use of great inclined planes, up which their heavy stones were dragged. It is now used on railroads in hilly countries and on many canals instead of locks, the boats being drawn up the sloping plane from one level to another.

In′cubator. [L. *Incubo*.] An apparatus for the artificial hatching of eggs, heat being applied instead of the natural warmth of the body. Several hundred eggs may be hatched in a single incubator.

India-rubber. The hardened juice of several kinds of trees, It is also known by the names *caoutchouc* and *elastic gum* or *resin*. The india-rubber of commerce comes chiefly from Mexico, South America, Madagascar, and the East Indies. The East Indian rubber is the juice of a kind of fig-tree, while the South American is that of the syringe-tree. A hole is made in the bark, and the juice is caught in a cup. It is pale yellow in color, and about as thick as cream, but when spread out it hardens and becomes nearly pure white. Previous to the beginning of this century india-rubber was used only for rubbing out pencil marks, but now its uses are very numerous. All kinds of elastic and waterproof goods are made from it. It is woven with silk, cotton, or woollen threads into a great number of fabrics. The discovery of the art of vulcanizing rubber by the addition of sulphur, which was made by Charles Goodyear, an American, in 1839, has largely added to its uses. Tubes, fire-hose, and gas-pipes, elastic rings or bands, door and window springs, mats, boots and shoes, machinery belts, and many other useful things are made out of vulcanized rubber, which does not soften in hot weather like common rubber. Hard rubber or ebonite is made out of india-rubber and sulphur heated much hotter than vulcanized rubber. Canes, combs, backs of brushes, buttons, surgical instruments, picture-frames, knife handles, and a great variety of other things are made from ebonite. India-rubber mixed with sulphur and coal tar makes a substance so hard and black that it resembles jet. This may be cut and polished and made into bracelets, breast-pins, sleeve-buttons, studs, watch-guards, and other useful and ornamental things.

Indian Corn. (See Maize.)

Indian Summer. A term applied in the United States to the period of mild weather which nearly always comes at the close of October, extending sometimes to the middle of November. It is rainless and the atmospere is apt to be hazy. In Europe a similar season is known as St. Martin's Summer.

In′digo. [L. *indicum*, from *India*.] A well-known and beautiful blue vegetable dye, obtained from the leaves of several species of plants which grow in the East and West Indies, India, Ceylon, Mexico, Brazil, Egypt, etc. Indigo is very extensively employed in dyeing and calico-printing. *White indigo*, discovered by Chevreul, results from the action of hydrogen on indigo. Indigo is made artificially in great quantities from *cinnamic* acid and *isatin*, which are derived from benzine.

Influen′za. An epidemic disease which comes suddenly, produces severe catarrh, and is very apt to develop into pneumonia or serious affections of other parts of the body. In France it is known as *la grippe*, which name has become common, and many occurrences of it are upon record, one of the most persistent of which appeared in Europe and the United States in the winter of 1889–90, and was still active more than ten years later. The disease is believed to be of bacterial origin, and is often fatal.

Induc′tion. An important electrical phenomenon, in which a charged conductor causes unlike electricity to appear in an insulated conductor on the end near it, and like electricity on the other end. In the same way a magnet induces the opposite magnetic charge in iron, and an electric current induces a momentary current in the opposite direction in a neighboring wire. In practice, the induced current is often used instead of the primary current. In long telegraph wires and ocean cables induction acts to check the rapidity of movement of the current.

Ink. [Fr. *encre.*] A liquor or substance used for writing or printing. *Writing ink* is made of gall-nuts, sulphate of iron, gum, and water. *Copying ink* has more gum than writing ink; while *blue ink* is made of Prussian blue, oxalic acid, and water; and *red ink* is got from Brazil wood, but now generally from potassium eosin. *Black printing ink* is much thicker than writing ink, and is usually made of lamp black or ivory black mixed with burnt linseed oil.

Inlay′ing. The art of ornamenting flat surfaces with pieces of wood, ivory, pearl, precious metals, etc., by inserting them into spaces cut out of the body of the substance in which they are to be inlaid.

Insectiv′orous Plants. A name given to various plants whose leaves are developed into traps for catching insects, upon whose juices the plant seems to feed. Well-known forms of these are the Venus fly-trap, the sundew, and pitcher plants.

In′sects. [L. *insectus*, cut into.] In point of number and variety of species by far the largest class of animals. The body, made up of a number of rings or segments, is divided into three parts — the head, forming one ring; the thorax, with three divisions; and the abdomen, with eleven rings. The head has two jointed feelers, called *antennæ*, which are used in smelling and as organs of touch and guidance, and three pairs of mouth appendages. The first pair, called *mandibles*, is used for cutting the food. Next come the first pair of *maxillæ*, and below these the second pair of maxillæ.

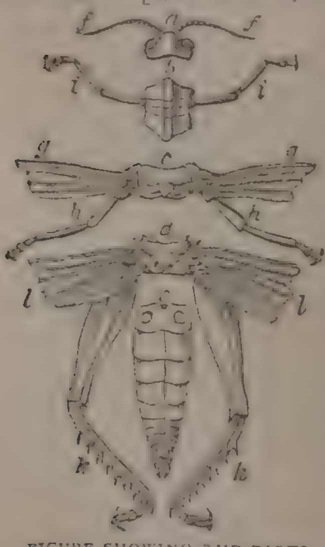


FIGURE SHOWING THE PARTS OF INSECTS.
a, head: *b c d*, thorax; *e* abdomen; *f f*, antennæ or feelers; *g g l l*, wings; *i i h h k k* legs.

Insects feed on different kinds of food, some living on animal and some on vegetable substances, while others suck juices. Hence arises a difference in the shape of their mouths—some being formed for biting and chewing, some only for sucking, and some for both. Three pairs of legs grow on the thorax, one pair on each ring; and they have usually either two or four wings also on the chest. The majority of insects are hatched from eggs, and these vary in number according to the kind of insect. Some kinds of insects, such as the hive-bee, the silk-moth, the cochineal and lac-insects, are very useful to man, other kinds, such as the locust, the grasshopper, the potato-bug, and many flies, are very harmful, destroying herbage and crops.

I′odine. [Gk. *ion*, a violet; and *eidos*, form.] A simple substance obtained from the ashes of seaweed; its vapor is of a rich violet color. Though an irritant poison, it is used medicinally in small doses.

Ipecacuan′ha. [Peruvian *ipi*, root; and *Cacuanah*, the district from which it was first obtained.] A plant found in the forests of Brazil, the root of which is used as an emetic.

I′ron. [AS. *iren.*] The most common and most important of all metals. Iron possesses properties so varied and useful as to give it the highest rank among the mineral productions of the earth. It is very hard and yet malleable; can bear a great strain or be made very brittle; is inflexible, but from it the most elastic springs can be made; it may be used for the heavy sides of a man-of-war, or the slender blade of a surgeon's knife.

Native-Iron. Of this there are two kinds:—1 *Telluric iron*, found in small grains in some basaltic rocks, and generally associated with other metals. 2. *Meteoric iron*—that is, masses of nearly pure iron which have fallen from outer space to the earth in the form of meteors. Some of these masses are of great weight, one found in 1871 near Disco Bay in Greenland weighing nearly 20 tons.

Iron Ores.—Iron is found chiefly in the earth's crust in combination with oxygen. There are several kinds of ores from which iron is made, but the most important are the various oxides, the carbonates, and the sulphides. From the two former almost all the iron of commerce is obtained. *Magnetic ore* is the richest of all the ores, and from it are made the finest iron and the best steel. It is found in large masses in Sweden, Norway, Russia, and North America, and in some parts of England. Some specimens of this ore form natural magnets. Magnetic ore when pure contains fully 72 per cent. of metallic iron. *Hematite ore* in its pure state contains about 70 per cent of iron. This ore is found in great abundance in Chili and other parts of South America, in Algeria, England, Norway, Sweden, and in large beds in Canada, Pennsylvania, Missouri, Michigan, Wisconsin and Wyoming. In addition to the ores mentioned there are many other kinds, such as *brown ore*, *bog ore* or *limonite*, *spathic ore*, etc.

Cast-iron, or pig-iron, as it is commonly called, is made by smelting or melting iron ore in a blast furnace. Iron smelting is necessary to free the ore from all foreign ingredients, to reduce the iron oxide to metallic iron, and to allow the reduced iron to combine with such an amount of carbon as to form therewith a fusible compound. Cast iron is used for making gas and water pipes, lampposts, pillars and fronts for buildings, railings and many other things. It contains from 3 to 6 per cent. of carbon, and cannot be hammered, as it is brittle. To make it into *wrought iron*—that is, softer iron which can be hammered or rolled into plates—the cast iron is melted in another kind of furnace, and stirred up so that the air can get to it. In this way the carbon is burned out, and it contains only ½ per cent. of carbon. Wrought iron is easily hammered into bars, rolled into plates, drawn out into wire, or made into *steel*. Iron plates for steam boilers and ships, anchors, chain cables, ploughs, wheel-tires, horseshoes, shovels and spades, nails and spikes, wire, the iron part of most tools, etc., are made from it. Pieces of wrought iron can be welded or joined into one by hammering them together when red hot. (See *Steel.*)

Irriga′tion. The watering of the earth to increase its fertility. The word is applied to flooding fields directly from streams, and to the digging of long canals and ditches to spread the waters of a stream over a broad section of land. It was practiced in very early times by the Egyptians and Babylonians, and is now much in use in many parts of the earth. It is being widely applied in the Western United States.

I′singlass or **Fish-glue.** [Corrupted from Du. *huizenblas*, the bladder of the sturgeon.] A substance consisting chiefly of gelatine, prepared from the sounds or air-bladders of certain fresh-water fishes. The finest is obtained from the sturgeon, which is very plentiful in the Caspian and Black seas and the rivers flowing into them; but isinglass is also made from the bladders of the cod and other fish, and quantities are produced in Brazil, North America, and the East Indies. It is much used in making jellies, ices and other kind of desserts, and in clarifying beer. It is the chief substance of Russian glue, noted for its strength, and used in stiffening linens, silks, gauzes, etc. Isinglass dissolved in acetic acid is a useful cement for repairing glass, pottery, etc.

Isother′mal. Having equal heat or temperature. Isothermal lines are those which pass through points of equal annual temperature upon the earth's surface. They are irregular in shape, the temperature of a place being not closely governed by its latitude. Thus in passing from western Europe to eastern America the lines may differ 10 or 11 degrees in latitude. In crossing the United States they reach higher latitudes on the Pacific than on the Atlantic coast.

I′vory. [Fr., from L. *ebur*, ivory.] The hard, fine-grained substance of a fine white color obtained from the tusks and teeth of the elephant. The name is also given to the tusks and teeth of certain other animals, as the hippopotamus, walrus, narwhal, etc. The tusks of the African elephant yield the best ivory, on account of their superior density and whiteness. They are of all sizes, but the largest weigh from 180 to 200 lbs. Indian and Ceylon elephants also yield much ivory, but the ivory used by Russian ivory-workers is that of mammoths found buried in the soil of Northern Siberia. Ivory is used in the manufacture of knife-handles, billiard balls, chess-men, dice, fans, combs, paper-knives, napkin-rings, brooches, organ and pianoforte keys, etc. Great taste and skill are often shown in working ivory, and some of the carved boxes, ornaments, and toys made of it are very beautiful. The Chinese and Japanese are very skilful in carving ivory. Ivory obtained from the hippopotamus is very white, and not grained like that of the elephant, and is used by dentists for making artificial teeth.

Vegetable ivory is the nut of a palm-like tree which grows on the plains of Peru, and on the banks of many of the rivers of South America. The nuts, about the size of hens' eggs, are exceedingly hard and white when ripe, and resemble ivory so much that they are used in the manufacture of buttons, umbrella handles, and small trinkets.

I′vy. [AS. *ifig.*] An evergreen plant of the genus *Hedera*, which creeps along the ground or climbs trees, rocks, walls, etc. Its leaves are very pretty, of a dark-green color, smooth and shiny. It is found almost throughout the whole of Europe, and especially in Great Britain. In North America it does not succeed very well, but on the Pacific coast it grows luxuriantly, and it is popular in Virginia and some of the Southern States. Various substances are got from the different parts of the plant. The stem yields a gum resin and the seeds a bitter substance called *hederin*. *Poison ivy* is a poisonous, climbing plant of the Sumach family. It is common on trees, etc.

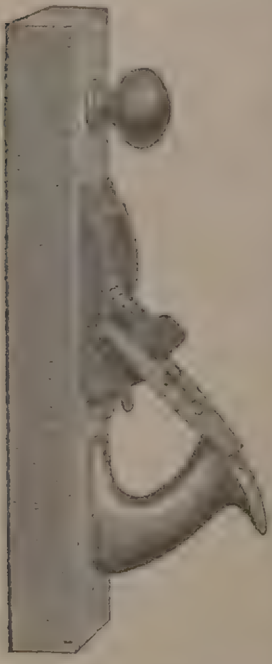
J

Jack. A hoisting or lifting device, consisting of a screw arrangement by which a heavy weight may be lifted with small power. The hydraulic jack is the most powerful of lifting machines. In its use water is forced through a small hole into a chamber of considerable dimensions. By its aid a man may lift 10 tons 1 foot in a minute and a half, or 100 tons in 15 minutes. The term jack is applied to many other tools used in the arts.

Jack′al. This animal belongs to the genus *Canis*, and has a close resemblance to the dog and the fox. The common jackal is of a grayish-yellow color, about 3 feet in length and 14 inches in height, with short ears and small eyes. Jackals sleep during the day in holes and burrows, and go out at night to hunt in packs, sometimes more than a hundred together. They keep up a constant howling, making the night hideous in the regions where they abound. Their food consists chiefly of carrion and decaying matter, but they also enter houses or tents, and are the pests of the poultryyard. The common jackal is found in Africa, from Barbary southwards to the Cape of Good Hope, and in Persia, Syria, and the southern regions of Asia. The striped jackal, the jackal-wolf, and the black-backed jackal are different species, all found in Africa.

Jack′daw. [*Jack* and *daw*.] A bird of the crow kind, smaller than the rook and carrion crow, in length about 12 inches. Its plumage is of a glossy black, and it has a short black bill and black legs. It is common in the British Islands, and is found over nearly all Europe, also in Asia and the north of Africa, but not in America. It builds its nest in cliffs, ruins, towers, and elevated situations, and in chimneys and in hollow trees. Its food consists of worms, snails, and insects. Jackdaws lay from five to six eggs of a greenish color, covered with small dark-brown spots. They are easily domesticated, and soon become familiar and imitate the human voice.

Jack Plane. A Carpenter's cutting and surface smoothing tool, from 12 to 17 inches in length and used to take off the roughtest surface of the board.



JACK PLANE.

Jac′onet. A light soft muslin, used for dresses neckcloths, etc.

Jade. [Span. *ijada*, flank.] A mineral, called also *oxstone*, of a greenish color, compact, and with a fatty lustre. It was believed to cure pain of the *side*, hence its name. Chinese jade is wrought into beautiful vases and other objects.

Jag′uar. A large and ferocious animal, of the cat family, found chiefly in South America, and often called the American tiger. It is found in North America as far north as the borders of Texas. It is larger than the leopard and is very strong. Its fur is of a brownish-yellow color, beautifully marked with dark ring-like spots, each ring enclosing several small black points. It resembles the leopard in color and general appearance, and, like it, can climb trees with great ease. The jaguar lives in thick forests near large rivers and lakes. Wild horses and mules are its favorite prey, and it feeds on turtles. South Americans hunt the jaguar in various ways, but chiefly with the aid of dogs and the *lasso*. Jaguar skins are very handsome, and are largely imported into Europe, and made into valuable robes, etc. It will not attack man unless impelled by hunger, or self-defense.

Jal′ap or **Julep.** [So called from ***Jalapa*** in Mexico.] (*Rose-water.*) The root of a plant much used in medicine as a purgative.

Japan′ning. The art of covering wood, metal, leather, paper, etc., with a thick coating of colored varnish. It was first practised by the Japanese, hence the name. Tea-trays, tin canisters, cash-boxes, coal-boxes, etc., are japanned in iron and tin works in large cities.

Jas′mine. A genus of long twining shrubs, bearing sweetly-scented flowers.

Jas′per. [Gk. *iaspis*.] A hard precious stone of various colors (usually red or brown), which takes on a high polish, and is used for rings, seals, vases, and other ornaments, and also for the decoration of costly buildings. It is one of the varieties of quartz, and is found in veins and embedded masses in many rocks.

Jaun′dice. [Fr. *jaunisse*.] A disorder of the liver, causing bile to mix with the blood, when the skin becomes yellow.

Jay. (*Garrulus.*) A genus of short-winged birds of the Crow family. The jay frightens small birds with its cry, and robs nests of their eggs. The European jay is of a yellowish-brown color, and resembles an ordinary pigeon in size. Its food consists chiefly of berries, seeds, fruits, and nuts, but it is also fond of worms, insects, and young mice. The American jay, or blue jay, has a far more brilliant plumage than the European jay, with a crest of feathers. The Florida jay is blue. The Canada jay is plain colored, and without a crest.

Jel′ly. A translucent juice which thickens when cold into a soft and trembling mass. The juice of currants and some other fruits thickens to jelly after boiling with sugar. A jelly is also made from Iceland moss, and there are various jellies made from animal substances,—as calves' foot jelly.

Jel′ly-fish. (*Medusæ.*) Soft-bodied ocean animals, which form a disk of an umbrella shape, with a mouth in its centre, opening downwards, and long tentacles surrounding the mouth or depending from the margin of the disk. They have stinging powers, and move by opening and shutting the umbrella disk. Their flesh resembles jelly, some of them being small and transparent, others quite large.

Jer′boa or **Jumping Mouse.** (*Dipus.*) A genus of rodent mammals allied to the mouse, having very short fore legs and remarkably long hind ones, and noted for their power of jumping by the aid of a long muscular tail. The average length of the body is about 8 inches, the tail often measuring 10 inches. They are common in Asia and Northern Africa, and a few species are found in Russia and North America. They live in burrows, are nocturnal in their habits, and hibernate.

Jeru′salem-ar′tichoke. [*Jerusalem*, corruption of Ital. *girasole*, or sunflower.] A plant whose root is sometimes used for food.

Jet. [From *Gagas*, a town in Asia Minor.] A hard black mineral, easily cut and carved, and capable of receiving a very beautiful polish. Jet appears to be a kind of bituminous coal, but much harder and smoother than that used for burning. Much of it is found near Whitby, Yorkshire, where it has been worked for centuries. It is made into buttons, mantel ornaments, necklaces, earrings, brooches, bracelets, and other trinkets. Jet is also found in France and Spain, and in these countries it is made into rosary beads, crosses, etc. Sometimes called *black amber*.

Jet′ty. A landing-place carried out so far that vessels may discharge their cargoes at all states of the tide; a breakwater for the protection of river or harbor mouths. Jetties are built out in pairs into the ocean so as to confine the outflow of streams and prevent the formation of bars. The Mississippi jetties, begun in 1875, deepened the South Pass of that stream from 14½ to 23 feet, the confined water sweeping the mud from the bottom.

JERBOA OR JUMPING MICE.

Jew′el. [Fr.] Any ornament of precious stone, metal, or other valuable material. A diamond or other stone in a watch on which the pivot turns.

Jew's-harp. A simple instrument of music, made of metal, and shaped like a harp. When played it is placed between the teeth, and by means of a little spring, which is made to vibrate by being struck with the finger, it produces a sound which is modulated by the breath of the performer into soft melody. Also called *Jew's-trump*.

Johan′nisberger. The finest kind of Rhine wine, made at Johannisberg monastery.

John-dory. [*John*, and Fr. *dorer*, to gild.] A flat sea-fish of a golden-yellow color, with a small round spot on each side; hence called *St. Peter's Fish*.

Joists. [Fr., to lie.] Pieces of timber, laid horizontally in parallel rows, resting on walls and girders, and sometimes on both, and to which the boards of a floor or the laths of a ceiling are nailed.

Jol′ly-boat. A small boat belonging to a ship.

Jour′nal. [Fr. *journal*.] A diary; a book containing an account of daily transactions and events; a *business* book in which every particular article or charge is entered; a paper published daily or at regular times.

Ju′jube. The name of a small tree or shrub and of its fruit, sometimes called lotus. The tree is a native of Syria, and is now cultivated in many parts of Asia and in Europe, chiefly for its fruit, which is dried as a sweetmeat. The common jujube paste is really a mixture of gum arabic and sugar, slightly colored.

Ju′niper. [L. *juniperus*.] A hardy evergreen tree or shrub, with dark-purple berries, which have a strong and peculiar flavor, and are much used for flavoring gin. The common juniper is found in Europe, the north of Asia, and the northern parts of North America. It attains no great height, being in general only a shrub from 2 to 6 feet high, but in favorable circumstances it becomes a tree from 15 to 30 feet in height. The fruit takes two years to ripen. *Virginian juniper*, or the red cedar of North America, attains a height of from 30 to 50 feet; and the wood, which is of a beautiful red color, is highly prized by turners, and is also largely used for cigar-boxes and lead pencils.

Ju′piter. The largest planet of the solar system. It is about 88,000 miles diameter, eleven times that of the earth, and rotates in less than 10 hours, its surface at the equator moving 28 times as fast as the earth's surface. Its distance from the sun is 485,000,000 miles.

Jute. The fibre of the inner bark of two plants, which are very extensively cultivated in India, especially in Bengal. Both plants are annuals, in height from 10 to 14 feet, with yellow flowers and smooth leaves. The stem is erect, smooth, and cylindrical, and the inner bark is separated from it by steeping in water. The fibre is of a yellow or buff color, comparatively strong, easily spun, and possessing a shining surface. It is largely used for making coarse cloth for bagging and sacks, and in the manufacture of carpets, tarpaulin, backings for floorcloth, manilla paper, etc. Jute has been woven into various fabrics in Bengal from a remote period, and there are now many jute factories in India. (See *Gunny*.)

K

Kalei′doscope. [Gk. *kalos*, beautiful; *eidos*, a form; and *skopein*, to see.] An optical instrument invented by Sir David Brewster in 1817. It consists of a tube containing two glass mirrors, making an angle of 60° with one another, and extending the whole length of the tube. One end of the tube has a small opening to serve as an eye-glass, and the other end has two glasses, one of ground and the other of clear glass, with little pieces of colored glass lying loosely between them. These colored bits of glass are reflected in the looking-glasses, and regular figures of the most beautiful form, which change whenever the instrument is shaken, are seen on looking through the instrument. It forms a cheap and pretty toy, and is also used, in a more expensive form, by pattern-drawers and others, who get from it an endless variety of designs.

Kan'garoo. An animal belonging to the Marsupial order of mammals, and found only in Australia, New Guinea, and the neighboring islands. Its distinguishing features are very short fore legs, which are not used for walking, remarkably long hind legs, by means of which it makes long leaps, and a pouch in which it carries its young for a certain period after birth. The kangaroo has a long, thick, and strong tail, and when resting and feeding it supports itself on its hind legs and its tail. Kangaroos live on vegetable food, mainly grass, which they consume in large quantities, two kangaroos eating as much grass as three sheep. They are hunted in various ways, chiefly by dogs, upon which they turn and strike heavy blows with their tails. The skin is much prized, and makes a valuable leather for shoes and gloves; and the flesh is largely eaten by the natives in Australia, and is said to be nutritious and to resemble mutton.

Ka'olin. A pure white clay, resulting from the decomposition of felspar in granite rocks. The finer kinds of porcelain are made from it.

Kelp. A dark-gray powder or ash, got by burning seaweed, used chiefly in the manufacture of iodine, and formerly of glass.

Kes'trel. A small bird of the genus *Falco* or hawk kind, like the sparrow-hawk.

Kid'neys. Two peculiarly-shaped glands which secrete the urine from the blood and send it into the bladder. In the human body they are situated one on each side of the abdominal cavity, and are spoken of as the right and left kidney. Their average length is fully 4 inches, and they weigh from 4 to 6 ounces each.

Kin'dergarten. [Ger. *kinder*, children; and *garten*, a garden.] A school or training-place for young children, in which instruction is given by means of games and other amusements; so called because first carried on in rooms opening on a garden. The system was devised by Friedrich Froebel in 1826. Since that time it has been gradually developing and extending.

Kine'toscope. An apparatus for taking and afterwards exhibiting a rapid series of photographs of moving scenes. By its use life-like pictures can be displayed. Various names have been given to modifications of this instrument, as Biograph, Vitascope, Mutoscope, etc., all based on the one principle.

King'bird. Also known as the Tyrant Fly-catcher and Bel-martin. It is found only in America east of the Rocky Mountains, and during the nesting season is very fierce. It will attack the largest bird that comes too near its nest, even eagles and hawks being driven off by this little tyrant. It will dart upward, alight on the back of its enemy, and with its sharp beak make him suffer for his temerity.

King'fisher. A genus of perching birds noted for their brilliant plumage. The kingfisher is usually found alone, perched on the bough of a tree on the banks of rivers. Here it will sit for hours watching for fish. It dives the moment it perceives its prey, carries the fish to the perch, kills it, and swallows it whole. The kingfisher makes its nest of fish-bones, ejected by the bird itself. It is found all over the world. The wood kingfisher of Africa feeds largely upon insects, snails, and fishes. The belted kingfisher of North America is slate-blue, with white breast, and feeds on fishes. The giant kingfisher of Australia feeds on lizards and insects.

Kite. [AS. *cyta.*] The name of a very active bird of the genus *Falco* or hawk. Its bill is short and strong, its wings are long, powerful, and pointed, and its tail is forked. The kite spends the greater part of the day on the wing, sometimes flying so high that it can scarcely be seen, and coming down at night to roost on tall trees. When in the air it lives mostly on insects, but its food consists also of moles, mice and carrion. The common kite and the black kite are found throughout Europe; the swallow-tailed kite is common in America. The carrion-feeding habits of this bird are seen to perfection in the birds found in Asia, and particularly in India.

Kite. A light frame of wood and paper constructed for flying in the air, chiefly for amusement. Kites get their name from the kind of hawk called kite, which has just been described, and which is often seen in the air, almost as still as a paper kite, gliding along without moving its wings. Kites are made of many different shapes, but the most common are the cross-kite, the house-kite, and the bow-kite. The natives of India, the Chinese, and the Japanese are very skilful in making kites, and often make them to represent animals, ships, castles, trees, and flowers. Kites are used to carry lines across deep chasms or over, the tops of steeples and high chimney-stacks, and are now employed in the study of the weather, being sent very high into the air

Kit'tiwake. A bird of the gull kind.

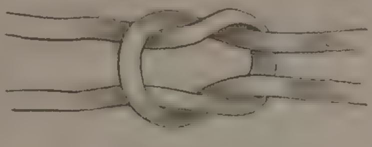
Knife. [AS. *cnif.*] Primitive men used shells, flints, and sharp-edged stones for knives. These were followed by bronze knives made of copper and tin; but knives made of iron and steel gradually took their place, as they were found to be more lasting and stronger. The best knives are now made of steel. In the manufacture of table-knives a bar of shear-steel is heated white hot and then hammered into shape on an anvil. This is called forging the blade. Penknife and razor-blades are made of cast steel. After forging, the blades are stamped with the maker's name, and then tempered by heating them red hot and cooling them quickly by dipping them in water. They are then ground and polished and fitted with handles.

CROSSED SLIP-KNOTS.

Knight. A title of honor, originally adopted during the feudal system, and given to soldiers of courage and experience. The knight took the title of Sir before his name. Knighthood was conferred of old by laying the blade of a sword on the shoulder of the one to be honored and repeating a formula declaring him a knight. There were several Orders of Knighthood. Knighthood is now a civil, not a military, rank.

Knot. In nautical language a division of the log-line serving to measure the rate of a vessel's motion. The log-line is divided by knots into sections, and the number of sections which run off in half a minute show the number of geographical miles or knots per hour at which the vessel is going. A geographical mile or knot is 6,086 feet, while an English statute mile is 5,280 feet. (See *Log.*)

Knots. There is an almost endless variety of knots, most of them in use on board ship, though different occupations using ropes, cordage, etc. have special kinds of knots. Knots used by sailors differ in form, size, and name according to their varied uses; as the diamond-knot, over-hand-knot, bowline-knot, buoyrope-knot, reef-knot, shroud-knot, stopper-knot, etc.


SAILORS-KNOT.

Ko'dak. A form of photographic camera adapted to take instantaneous negatives by the "snap-shot" process. It is made in the form of a small box, with a lens and shutter on one side, and a reflector on top to aid the operator. The negative is taken by pressing a button, which opens the shutter for an instant. (See *Camera.*)

Kou'miss. A fermented drink made from mare's milk originally, though it may be made from the milk of any animal. The article usually sold under this name is made from cow's milk, yeast being used to cause it to ferment. It is esteemed a nutritious beverage and an aid to digestion.

L

La'bel. A narrow slip of silk, paper, metal, or parchment, containing a name or title, and affixed to anything, to tell what or whose the thing is.

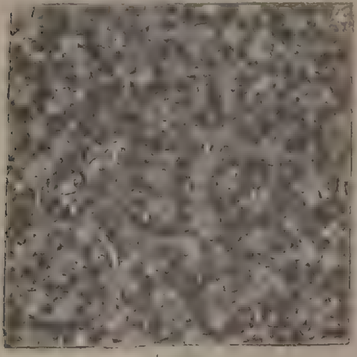
Labur'num. A small tree, a native of the Alps, much planted in shrubberies and pleasure-grounds on account of its glossy leaves and clusters of beautiful yellow flowers. The laburnum is a very hardy tree, and though of rapid growth its wood is hard, fine-grained, and very durable, and is highly valued by cabinetmakers and turners. It is used also for wedges, pulleys, pegs, bows, handles of knives, and other instruments. The seeds are poisonous.

Lab'yrinth. A building or ground space full of winding passages, which are very difficult to traverse. There were three famous ones in ancient history. One at Arsinoë in Egypt had 3,000, apartments, half of them underground. There was a similar one in Lemnos, and a smaller but famous one in Crete—though this is traditional and its existence doubtful.

Lac. A resinous substance found on certain trees in different parts of the East Indies. It is produced by punctures made by a very small insect called *Coccus lacca.* These insects live on the sap of the trees, and soon become fixed to the branches by the juices which ooze out. The twigs containing the deposit are broken off, and form the *stick-lac* of commerce. *Seed-lac* is the deposit broken off from the twigs, while *shell-lac* is obtained by placing the twigs in hot water, which melts off the gum. It is then purified by straining through cotton bags, and dried on strips of wood. The water in which the lac has been melted is colored red by the bodies of the insects, and after the melted lac is taken out this water is strained and evaporated, and the sediment is cut up into small cakes and sold as *lac-dye.* Lac-dye is largely used in dyeing silk and wool. Shell-lac is used in the manufacture of hats to stiffen the calico frame, and in making sealing-wax and different kinds of varnish—"Lac" is the same as the numeral lakh—a hundred thousand—and is indicative of the countless hosts of the lac insects.

Lace. [Fr., from L. *laqueus*, a noose.] A fabric formed of threads of cotton, wool, flax, silk, silver, or gold, used chiefly for ornamenting dresses. Lace is made either by hand or machine. To that made by the hand the term real lace is sometimes applied, and also pillow or bobbin lace, from being woven upon a pillow or cushion by means of bobbins. Much of the lace now used is made by machinery, the machines at present in use being modifications and improvements on the bobbinet machine invented by Mr. Heathcote of Tiverton in 1809. Nottingham in England, and Alençon, Brussels, Mechlin, and Valenciennes are centres of this industry

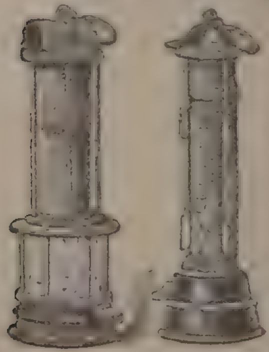
Lac′quer. [From *lac*, a gum or resin.] A varnish composed of shell-lac dissolved in alcohol with gamboge, and used for coating metals, chiefly polished brass, to which it gives a golden bronze color, preserves their lustre, and secures them against rust. The name is also given to a varnish made by the Japanese and Chinese from the juice of the laquer or varnish tree found in these countries. *Lacquer-ware* consist of various articles, such as boxes, trays, cabinets, etc., many of them decorated by inlaying, gilding with gold or silver, designs in color, or carving. The Japanese and Chinese excel in this work, and give the articles a beautiful finish.



Lacrosse′. [Fr. *la crosse*, the hooked stick.] A game of ball, first played by the North American Indians, now common in Canada.

Lady-bird. (*Coccinella.*) A small kind of beetle of a brilliant red, orange, or yellow color, with black spots, or sometimes black with white, yellow, or red spots. It lays its eggs in little collections under the leaves of plants, among the plant-lice, on which both the larvæ and the full-grown insects feed.

Lamp. [Gk. *lampas.*] A vessel used for giving light by means of a wick dipped in oil and lighted. In ancient times lamps were simply flat vessels made of earthenware or stone. Specimens of these have been found in the ruins of Pompeii and Herculaneum. In later times they appear to have been formed from various metals, more particularly bronze. Lamps are now made to give an excellent light, and are also used for heating and cooking. Rushes, animal fats, and fish oils were first used for burning in lamps. These were followed by vegetable oils, which in turn have been largely superseded by mineral oils, such as paraffin, petroleum, kerosene, crystal and mineral sperm. The *safety-lamp* invented by Sir Humphrey Davy in 1815 is of great use in mining. It is covered with wire gauze, and gives the miner sufficient light without the danger of setting fire to inflammable gases. *Arc lamps* and *incandescent lamps* are devices for producing light by electricity.



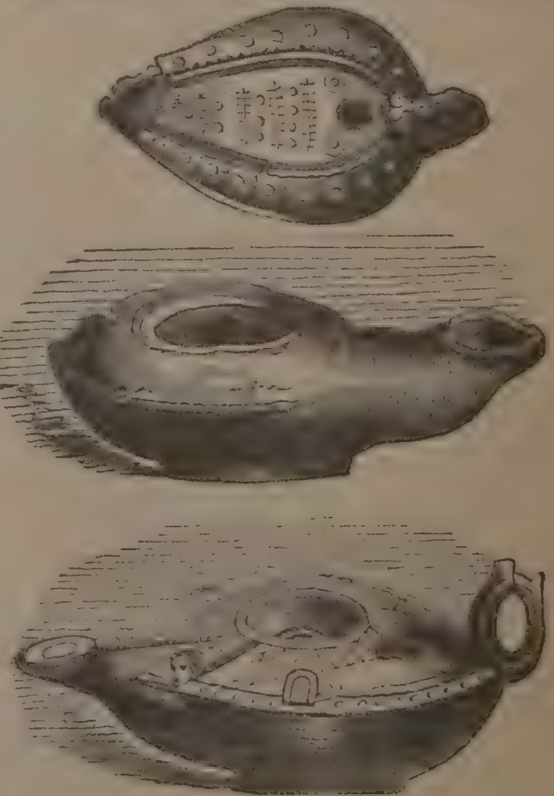
CLANNY LAMP. DAVY LAMP.

Lamp′black. A fine soot formed by burning resin, petroleum, pitch, tar, and oils and fats in close iron vessels. During combustion the dense smoke passes into a chamber covered with a coarse woolen cloth, and a thick coating of lampblack is soon formed, which is shaken off and put up in barrels for sale. Lampblack is used by artists and painters, and is the chief ingredient in China ink and printing ink.

Lam′prey or **Rock-sucker.** A species of fish somewhat resembling the eel in form. Its body is destitute of the paired fins found in most other fishes, is without scales, and covered with a glutinous mucus. The mouth is circular in form, and by it and the tongue, which acts like a piston, the animal attaches itself firmly to fixed objects. Formerly the lamprey was highly esteemed as an article of food, and even of luxury, but is not so commonly used now.

Lance. [L. *lancea.*] A weapon much used by the ancients, consisting of a long shaft with a sharp point. It was an important weapon of war in the Middle Ages, and though now differing in form is still used by European cavalry. Lances are now made of ash or beech wood, about 12 feet long, with a steel point 8 or 10 inches long. Near the point is a small flag, intended to frighten the horses of the enemy. When not in use the lance is carried in a leathern shoe by the right stirrup, a leathern thong on the right arm keeping it in position. In use it is carried under the right arm.

Lancewood. The wood of a tree found in the West Indies, chiefly in Jamaica, of which it is a native, and possessing great toughness and elasticity. It is used by coach-builders for shafts and carriage-poles.



ANCIENT LAMPS.

Land-crab. Land-dwelling crabs, of which there are many species. The Black or Mountain Crab of the West Indies lives from one to three miles from the sea, to which it travels, in immense numbers, in April or May, for the purpose of laying its eggs. It is chiefly active at night.

Lapis Laz′uli. [L., azure stone.] The name of a mineral of a rich blue color, consisting chiefly of silica and alumina, with sulphates of soda, and iron in spots or veins. It is found in Persia, China, Chili, and Siberia, and is used for ornamental purposes, especially for inlaid work. In the marble palace built by the Empress Catherine at St. Petersburg there are entire apartments inlaid with lapis lazuli. It was much esteemed by the ancients, who used it for engraving and for vases.

Lap′wing. A bird of the Plover family, with long, broad wings, which from their regular, slow flapping have gained for it the title Lapwing. It is also known by the name *Peewit*, from its peculiar cry. Lapwings are common in Britain all the year, and are also widely distributed in Europe and Asia. They frequent marshy pastures, feed on worms, slugs, and insects, and are hunted for their flesh. Their eggs, which are known as plovers' eggs, are highly esteemed, and fetch good prices in the British markets.

Larch. [L. *larix.*] A cone-bearing tree, common in Europe, Asia, and North America. The European larch attains a height of from 60 to 100 feet, with a trunk of from 3 to 4 feet in diameter. The larch grows rapidly, and is considered to be fit for every useful purpose in forty years' growth. The wood is compact and strong, of a reddish or brown tinge, and is used for railway sleepers, hop-poles, scaffold-poles, and for ship-building. The bark is used for tanning leather. The American larch, or hackmatack, or tamarack, as it is sometimes called, is a slender tree, but its wood is heavy and cross-grained, and highly valued for ship-building and for railway ties.

Lard. [Fr. *lard.*] The fat of the hog after being separated from the flesh and melted. It is largely used for culinary purposes. Lard consists chiefly of stearin, which is a solid and olein, which is a liquid fat. The former is used in candlemaking, and the latter as a valuable lubricant for machinery.

THE LARK.

Lark. [AS. *laferc* or *laverock.*] A well-known bird of the family *Alauda*. The best-known species is the skylark, a familiar songster, remarkable as one of the very few birds which sing freely while on the wing. It begins to sing when it rises from the ground, and though its notes are feeble and interrupted at first, they swell out to their full tone as the songster ascends, and may be heard long after the bird has passed from the range of vision. The larks may be considered as especially birds of the fields and meadows, the nest being made of dry grass, in a hollow in the ground.

Lar′ynx. [Gk. *larynx.*] The upper part of the windpipe or trachea forming the organ of voice. It is situated between the windpipe and the base of the tongue, at the upper and front part of the neck, and opens above into the throat (*q. v.*), and below into the windpipe. The skeleton of the larynx is composed of five principal cartilages, and these are connected by ligaments known as vocal cords, the movements of the organ being regulated by two sets of muscles.

Las′so. [Span. *lazo.*] A rope or long thong of leather with a running noose, used for catching horses, cattle, etc.

Lathe. A machine by which wood, ivory, metals, and other materials are turned and cut as they revolve by a tool held in the hand or fixed in a slide-rest. All the rounded parts of furniture, such as legs of tables, chairs, and stools, the balusters of staircases, tool handles, round rulers, etc., are made on the lathe. Billiard balls and chess-men, and all the round parts of engines and other machines, are made on various kinds of lathes. Articles of irregular form, such as the stocks of guns and pistols, and hollow things, such as wooden bowls and dishes, bread platters and boxes, are also made on the turning-lathe.

Laths. The name given to thin, narrow strips of wood, rarely longer than four feet, used for nailing to the uprights of partition walls, and to the rafters of ceilings. They are placed slightly apart to receive the plaster, which, by being pressed into the spaces, is held firmly when it dries. Laths are now mostly sawn by machinery from Baltic fir or Canadian deal.

Lat′itude. Distance from the equator north or south towards the poles. Lines of latitude are imaginary lines which surround the earth, parallel to the equator, diminishing in length until they reach the poles, where they vanish.

Lat′tice. [Fr. *lattis*, lath-work.] Any work made by crossing laths, rods, or bars of wood or iron, and forming open squares like network; a window made in this way.

Lau′rel. [L. *laurus.*] The name given to a genus of plants, consisting of trees and shrubs, whose leaves and fruit are bitter, astringent, and aromatic, and were formerly much used in medicine. Laurel or bay leaves are now used for flavoring in cookery. The laurel or sweet bay is a small evergreen tree, found in the south of Europe and north of Africa. It has beautiful glossy leaves, and bears black berries about the size of wild cherries. This laurel is celebrated by poets, and used to decorate temples and the brows of victors. The victors in the Pythian games were crowned with the laurels of Apollo, and thus the laurel became the symbol of triumph in Greece and then in Rome. The American laurel is found almost all over the United States.

growing chiefly on rocky hillsides. Its wood is hard and fine-grained, and is used by turners for making chisel handles.

La′va. [It. *lava.*] The name given to the melted matter which bursts or is thrown from the mouth of a volcano. It flows like melted glass or iron down the sides of the mountain, but speedily cools and hardens into a porous mass. Ancient lavas form extensive rock strata in some localities, as in the western United States.

Lav′ender. (*Lavandula.*) A delightfully fragrant plant, much used in making perfumes. The leaves and flowers of lavender are said to have been used by the ancients to perfume their baths; hence the name *Lavandula* may be derived from *lavare*, to wash. The common lavender grows wild on stony mountains and hills in the south of Europe, and is largely cultivated in gardens in Surrey in England and near Philadelphia. The flowers of the lavender are often put into wardrobes to keep away moths. *Oil of lavender*, largely used in medicine, is made by distilling the flowers with water; and *Lavender water*, one of the most popular of all perfumes, is obtained by dissolving oil of lavender with smaller quantities of spirit and rose-water.

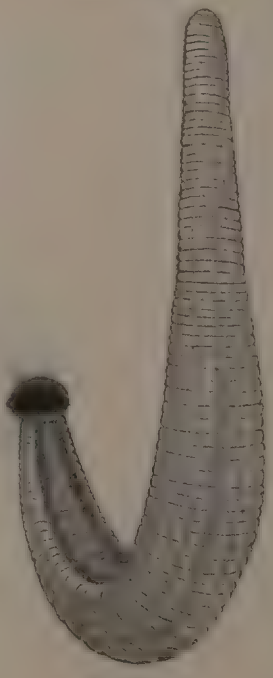
Lawn Tennis. A favorite ball game, played on a smooth surface divided by a net. The ball is sent by use of a racket, effort being made to return it over the net as often as possible.

Lead. [AS. *læd.*] A well-known metal of a bluish-white color, very heavy, easily melted and cut, and which may be hammered or rolled out into sheets and drawn into wire. It has been used from very early times, and articles made of it by the ancient Romans—such as water-pipes, water-tanks, weights, rings, etc.—have been found. Lead is soft, highly malleable, and a poor conductor of heat or electricity. It is largely used for water-pipes and cisterns, and for covering the roofs and gutters of houses. Lead is found in a large number of minerals, though often in very small quantities. Most of the lead now in use is obtained from the ore called galena or sulphide of lead. This ore is found in many parts of the world, but the purest veins are got in Great Britain, Germany, Spain, and the United States. The process of smelting the galena ore to get the pure lead differs from that of smelting iron ore, and is done in an entirely different kind of furnace. *Sheet lead* is made by rolling slabs of lead between heavy iron rollers until they are thin. Thick sheets are used for lining tanks and water cisterns, and for covering roofs, and thin sheets for wrapping up snuff, lining tea-chests, etc. Lead is used in alloy with other metals—forming, when mixed with arsenic, the alloy from which shot is made; with tin, pewter and solder; and with antimony, type-metal. Lead and its compounds are poisonous.

Leaf. A flat, expanded organ of a plant, varying in shape, and situated usually at the extremity of the twigs. It is employed in elaborating the plant food. The crude sap enters the leaf, where it receives carbon from the carbonic acid of the air. This changes the character of the sap and adapts it to serve as plant food.

League. [L. *leuca*, a Gallic mile.] A measure of distance of ancient origin. The Roman league was equal to 1,500 paces, each of 5 feet. The league is used as a nautical measure, and signifies the 1-20th part of a degree—3 geographical miles, or 3.45 English statute miles. The land-league is approximately 3 statute miles. Its length varies in different countries.

Leather. [AS. *lether.*] The hides or skins of animals dressed and prepared for use by tanning and otherwise. The most important leather-making hides are those of oxen, but various kinds of leather are made from buffalo and horse hides from the skins of sheep, goats, kids, hogs, seals, walruses, rhinoceroses, elephants, antelopes porpoises, kangaroos, alligators, and certain snakes and sharks. The process of tanning varies according to the materials employed, and the nature and thickness of the hides and skins. In this process tan made from oak or hemlock bark, or other woods containing the astringent substance called *tannin*, is used. The skins, after being cleaned of hair and flesh and otherwise prepared, are soaked in a solution of tan-bark and water, remaining until they are thoroughly impregnated with tannin. This has a preservative action and converts the hides into leather.



LEECH.

Dressed leather. After leather has been tanned, the currier and leather-dresser fit it for the many uses to which dressed leather is applied by a varied series of finishing operations. The surface of the leather is smoothed, and its thickness equalized. It is made soft, flexible, and water-proof; blackened, enamelled, or dyed.

Russia leather is tanned with birch-bark, which gives it a peculiar odor, and prevents moths and other insects from injuring books bound with it.

Morocco leather is so called because it was first brought from Morocco. It was originally made from goat-skins tanned with sumach, but now calf-skins and sheep-skins are used. Morocco leather is now made in France and in the United States, and is largely used for covering chairs and sofas, for lining coaches, for book-binding, and for making pocket-books.

The finest gloves and ladies' shoes are made of kid leather. Sheep-skin is largely used for book-binding, hog-skin for covering saddles, horse-hide for harness, collars, etc., and cow-hide for boots and shoes. A fine leather is made from seal-skin, and the skins of alligators are sometimes tanned for boots and shoes.

Leech. [AS. *læccan.*] A worm-like animal possessing one or two sucking discs. It is found in fresh and salt water, and sometimes on land. The medicinal leech is from 2 to 3 inches in length, with a minutely-ringed body, composed of 102 skin rings, and has a sucker moved by strong muscles. This species of leech is largely used in abstracting blood from the body for medical purposes.

Leek. [AS. *leac.*] The *Allium porrum*, a plant allied to the onion and used in soup.

Le′gion. The name given to a division of the Roman army, which corresponded to a brigade in modern armies. The legion—3,000 and afterwards 6,000 strong—was divided into centuries or companies of 100 men each. The word as now used indicates a great number.

Lem′ming. A small animal of the rat family, found in Scandinavia and Finland. It is a vegetable feeder, and is remarkable for its occasional migrations, in which bands of immense multitudes pass from the mountains to the sea. Great numbers are destroyed by carnivorous birds and animals and thousands are drowned, few living to return.

Lem′on. The name of a tree (*Citrus limonum*) and its fruit; a native of Southern Asia, but now cultivated in the south of Europe, especially in Sicily, in the West Indies, and in California and Florida. It forms a straggling bush, and is more delicate than the orange. There are many varieties of the lemon, but the most common are the common or Genoa lemon, the thin-skinned lemon, the sweet lemon, and the citron lemon. The chief products of the lemon are the juice and the oil. The juice has a peculiar and agreeable flavor, due to citric acid, and is much used in the well-known refreshing drink called lemonade. It is also very useful in the prevention and cure of scurvy. The rind of the lemon is used by cooks and confectioners for flavoring. The oil of lemons is extracted from the outside part of the peel either by pressure or by distillation, and is much used in medicine and in perfumery.

Le′mur. A family of arboreal animals bearing some resemblance to the monkeys in their mode of progression and their opposable thumbs and great toes. They are much less active and intelligent than the monkeys. They are chiefly natives of Madagascar.

Lens. [L. *lens*, a lentil seed, which is much like the shape of a convex lens.] A piece of glass or other transparent substance, which may be spherical on both sides, or one side may be spherical and the other a plane surface. There are many forms of lenses, their purpose being to refract the rays of light, causing them to converge to a point, to diverge, etc. Lenses are usually made of flat pieces of glass, and the greatest care is needed in grinding and polishing them, as the least unevenness in the surface would spoil them. They have many uses, but the most common is that of making eye glasses and spectacles—convex lenses being used for far-sighted and concave lenses for near-sighted persons. Lenses of various kinds are used in making opera-glasses, microscopes, stereoscopes, telescopes, and other instruments.

Lent′il. [Fr. *lentille.*] An annual plant not unlike the bean, a native of the countries bordering on the Mediterranean, and cultivated from the earliest times. It is now grown in many parts of Europe and Asia, the straw being used as fodder for sheep and cattle. The flour of lentils is made into lentil soup, which is considered highly nutritious.

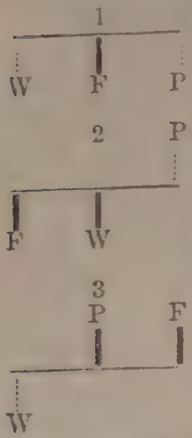
Leop′ard. [L. *leo*, and *pardus.*] A rapacious quadruped of the genus *Felis* or Cat group, found chiefly in Africa, though not uncommon in some parts of Asia. In general appearance it resembles the tiger, though not nearly so large. Its head, neck, back, and limbs are covered with black spots on a fur of a yellow color, whilst its sides are marked by at least ten ranges of black spots of a larger size. The leopard is very active, and can leap with the greatest ease, or ascend trees in pursuit of prey. It lives chiefly in thick forests, and its prey consists of deer, antelope, monkeys, and smaller animals, but it will sometimes visit farms and villages and feed on pigs, poultry, goats, sheep, or dogs. The leopard seems to dread and flee from man, and will only attack him when closely pursued or brought to bay. Leopards are captured by means of pitfalls covered with branches of trees, on which pieces of meat are placed as bait. They are chiefly valued for their skins.

Lep′rosy. A so far incurable skin disease, in which scaly patches, circular in form, appear on the skin and gradually spread. Its progress is very slow and those attacked by it may live for years. It is contagious and was very serious in ancient times and in the Middle Ages, the only treatment being to keep the lepers separate. It is now rarely seen in civilized countries. Of recent years it has been severe in the Hawaiian Islands, where the lepers are all sent to a settlement on the island of Molokai.

Let′tuce. [Fr. from L. *lactuca*, which is from *lac*, milk, the plant having a milky juice.] An annual plant, supposed to be a native of the East Indies; cultivated from remote antiquity, and now grown all over the world where the climate admits of it. The two principal kinds are the coss lettuce, with oblong upright leaves, and the cabbage lettuce, with rounded leaves and a head like a cabbage; and of these two kinds there are many varieties. The leaves of lettuce are used as a salad, and though they do not contain much nourishment, they are easily digested and gently laxative. Lettuce-opium is made from the juice of the plant, and is used medicinally to allay pain and induce sleep.

Lev′el. An instrument by which to find or draw a horizontal line in setting buildings. The *spirit-level* has a bubble of air on the surface of spirits of wine enclosed in a glass tube. In water-levels water is used instead of mercury or spirits of wine.

Le′ver. [Fr. *levier*.] One of the mechanical powers. It consists of a bar of wood or metal, supported by and movable at some point of its length round a prop, called the *fulcrum*, while at the other points are placed the *weight* or resistance to be overcome and the *power* or force which overcomes it. Levers are divided into three kinds, namely—(1) when the fulcrum is between the weight and the power, as in the crowbar; (2) when the weight is between the power and the fulcrum, as in rowing a boat; (3) when the power is between the weight and the fulcrum, as in raising a ladder from the ground. Bones of animals are levers of the third kind.



Ley′den-jar. [Invented in Leyden, Holland.] An instrument used to accumulate electricity. It is made of glass, covered on both sides with tin-foil nearly to the top, and for the purpose of charging it a brass knob is fixed to the neck of the jar, through which the electricity passes to the interior tin foil. (See *Electricity*.)

Li′chens. [Gk. *leichen*.] These are flowerless plants, without separate stems or leaves, found on rocks, trunks and branches of trees, walls and fences, and on barren soil. They are common everywhere and at all levels, many of them growing on mountain sides to the verge of perpetual snow. Lichens have no roots, but grow by receiving moisture through all parts of their surface. They contain a kind of starch, a bitter substance, a resin, and various coloring matters. They yield rich dyes of various colors, some of which are used in dyeing silks. Iceland moss is a lichen which grows in the most barren parts of Iceland and other cold countries, and is used for food and medicine. The reindeer lichen, covering the barren plains of Lapland and Siberia, is the chief food of the reindeers; and at one time, when grain was very scarce in Sweden, this lichen was ground up with flour to make bread. The *tripe de roche* is a lichen growing in the northernmost parts of North America, which the inhabitants there eat mixed with the roe of fishes. (See *Moss*.)

Life′boat. A boat constructed for saving persons in cases of shipwreck. Its chief qualities are strength, to resist the violence of waves, a rocky beach, or collision with the wreck; buoyancy, to avoid foundering when a sea is shipped; ability to right itself when capsized, facility in turning, and provision for speedy launching.

Light. [AS. *leoht*, *liht*.] The agent which produces vision and thereby enables us to see objects. Light comes to us from self-luminous bodies in the heavens—such as the sun, the fixed stars, nebulæ, and some meteors; and from substances on the earth—such as the electric light, burning gas and oil, etc. Light proceeds from all luminous bodies in straight lines, each one of which is called a ray of light. It is supposed to consist of undulations or waves in a rare substance called the luminiferous ether. It moves at the rate of over 186,000 miles per second, or more than a million times faster than sound, and it takes eight minutes for the light of the sun to reach the earth. When light falls upon the surface of a body, part of it is *reflected*, the rest enters the body. Thus, when we look at a house, the light goes first from the sun to the house, and then glances from it into our eyes, and thus we are able to see a thing which does not make any light itself. When a slanting ray of light passes from air into water, glass, or anything through which it can shine, the ray in the water, glass, etc., though still a straight line, is not a continuation of its old path, but is bent as it passes from one medium to the other. This bending of the ray is called *refraction*. (See *Prism*.)

Light′er. A large, open, flat-bottomed boat used in loading and unloading ships.

Light′house. A tower or building erected on headlands along the coast, and on rocks in the sea and in rivers, and at the entrance to harbors, from which a light is shown at night to guide mariners in navigating ships, and to warn them of hidden reefs or dangerous shores. *Lights* are **fixed, revolving, flashing, colored, and intermittent.** There are 530 lights round the British coasts, and they are so placed that at any point a ship is always in sight of a light. About 2,000 lights are on the United States coasts.

Light′ning. The vivid flash of light which accompanies a sudden discharge of atmospheric electricity. It occurs in three distinct forms—namely, forked lightning, sheet lightning, and ball-lightning. In forked lightning the path taken by the electricity is that which gives the least resistance, and is distinctly seen to be made up of straight lines and sudden bends. Sheet-lightning appears as a diffused glare of reddish color, spread over a considerable extent of the sky, and is sometimes called summer lightning, as it is of frequent occurrence in warm weather. Ball-lightning is a very destructive and dangerous form of lightning, but happily of rare occurrence.

Lig′num-vitæ. [L. *lignum*, wood; and *vitæ*, of life.] The name of the wood of the guaiacum tree, which grows in the West Indies and South America. The wood is very heavy, hard, close-grained, and tough, and is used for making pulleys, wheels in ships' blocks, pestles, rulers, and other articles which require to be of a tough material. The resinous juice of the tree is used in medicine in cases of rheumatism and skin diseases.

Lil′ac. [Sp. *lilac*.] A beautiful and fragrant flowering shrub, a native of Persia brought to Vienna about three hundred years ago, and now cultivated as a familiar garden ornament throughout Europe and North America. The wood is fine-grained, and is used for turning, inlaying, and making small articles. A fragrant oil can be obtained from the leaves by distillation.

Lil'y. (*Lilium.*) The popular name of a family of plants of many species, producing flowers of great beauty and variety of colors. The root is a scaly bulb, the stem herbaceous and simple, sometimes several feet high, and bearing elegantly-formed flowers near the summit. The white lily is a native of the Levant, and is now extensively cultivated in gardens, its large white flowers being as much prized for their fragrance as for their beauty. The orange lily and the martagon or Turk's cap lily are natives of the south of Europe, and now form very showy ornaments of the flower-garden. The tiger lily is a native of China; and among the many species in North America the finest is the *superbum* (L.), which grows in marshes to the height of from 6 to 8 feet, bearing reflexed orange flowers spotted with black.

Lime. [AS. *lim.*] An alkaline earth, found as a carbonate in chalk, marble and limestone. Quicklime is obtained by heating pure carbonate of lime to full redness in lime-kilns, when the carbonic acid is expelled and lime is left. When lime is moistened with water it swells up, gives off much heat and steam, and changes into a soft white powder, commonly called slaked lime (*calcium hydrate*). In this form it is used for purifying coal gas, in making mortar and plaster for building purposes, for removing the hair from skins in tanning, making paper pulp, and as a manure for land. When slaked lime is put in cold water and allowed to settle, the clear water is *lime-water*. In addition to the uses already mentioned, lime is used in the manufacture of washing-soda, bleaching-powder, and ammonia-water; in refining sugar, and also in iron-furnaces, lead-smelting, and glass-making. Bleaching-powder, commonly called chloride of lime, is a dry white powder, with a slight acid smell. It is largely used as a disinfectant. Carbonate of lime exists in great abundance in nature, and when crystallized is known as *Iceland spar*.

Lime-light. A light of great brilliancy, also called Drummond light, from its inventor. It consists of a burning jet of oxygen and hydrogen directed upon a cylinder of lime. This becomes white hot and yields an intense white light which has been seen at a distance of 112 miles. It is much used in the magic-lantern and the reflecting microscope.

Lim'pet. [L. *lepas.*] A small shell-fish which forms a *vacuum* under its shell, and adheres to rocks, being pressed by the weight of the atmosphere.

Lin'den or **Lime.** A large and beautiful tree, of which the American linden often grows to the height of 80 feet, and to 2 or 3 feet diameter. The leaves are large and serrated. The wood is white and soft, much used for carriage and cabinet work. The inner bark is strong, and ropes are made from it. In Europe the linden is also called the lime tree. The principal street of Berlin is named *Unter den Linden* (Under the Lindens).

Lin'en. [L. *linum*, flax.] A cloth very much used, made of flax, which is woven into such goods as tablecloths, cambric, lawn, shirting, sheeting, towels, etc. Linen is manufactured in the British Islands, and in many manufacturing districts in Europe, particularly in France, Belgium, and Germany. Linen thread is prepared from fine bleached linen yarn.

Ling. A fish resembling the cod in form, but longer and more slender.

Lin'net. [Fr. *linot.*] A well-known song-bird, widely distributed in Europe and in the northwest of Africa. It is barely 6 inches in length, feeds on soft seeds, and forms its nest of soft stems and moss, lined with wool and down, in which it lays from four to six eggs of a bluish-white ground, speckled with reddish-brown, and generally rears two broods in a season.

Lino'leum. A kind of floor-cloth made of ground cork and oxidized linseed-oil spread on jute canvas, with oil-paint coated on the back. It was invented by Walton in 1860.

Lin'seed. [AS. *lin*, flax; and *sæd*, seed.] The seed of flax, largely used for making *linseed-oil* and *oil-cake*. In making oil the seeds are bruised or crushed, then ground and pressed in a hydraulic or screw-press, either cold or heated by steam. The seeds give more oil when heated, but the cold-pressed oil is the best. Linseed-oil is largely used in making paints, varnishes, and printing inks. The remains of the seeds after the oil is pressed out make oil-cake, which is valuable for feeding cattle. Linseed itself is excellent food for cattle and for poultry.

Lint. [AS. *linet.*] Linen cloth or rags scraped so as to form a soft material suitable for dressing wounds and sores.

Li'on. [Fr., from L. *leo.*] The largest representative of the *Felidæ* or Cat family. Its distinctive features are the large size of its head; the great mane, which covers the head, neck, and shoulders of the males; the uniform tawny color of the skin, without spots or stripes; and the tuft at the extremity of the tail. It attains its full growth when about seven or eight years old, and a male lion of the largest size will then measure about 8 feet, and the tail about 4 feet. The lioness is smaller, and has no mane. Lions are found in the tropical regions of Africa and Asia. Their lurking place is near a spring or by the side of a river, where, concealed among the brushwood, they wait for the animals coming to drink. They hide away in the daytime, and prowl about in the evening and early morning, and sometimes all night long, their eyes being better adapted for the night and twilight than for the day. They feed on antelopes, zebras, giraffes, and wild cattle, and sometimes carry off horses, sheep, and other domestic animals.

Liq'uid. [L. *liquidus.*] A fluid or flowing substance, distinguished from a solid by yielding laterally to pressure. It always returns to the same level.

Liquid Air. Air reduced by great pressure and intense cold to the liquid state. This process, of recent discovery, can now be performed with ease and rapidity, large quantities being produced at a low cost. Efforts are being made to use it as a source of power. Air can also be frozen into the solid state, and every known gas, even the volatile hydrogen, can be liquified.

Liq′uorice. The word liquorice means "sweet root." The liquorice plant has stems 3 to 4 feet high, with small blue, violet, or white flowers, and the roots are sometimes half an inch thick and a yard long. It is cultivated in the south of Europe, chiefly in Spain and Italy. The roots are much used by porter-brewers. Spanish liquorice or liquorice juice is largely imported from the south of Europe in rolls or *sticks*, packed in bay leaves, or in the form of an extract run into boxes of about 2 cwt. each.

Lithog′raphy. [Gk. *lithos*, a stone; and *graphein*, to write.] The art of tracing letters, figures, and other designs on stone, and of transferring them to paper by impression. It was invented in 1796 by Alois Senefelder in Bavaria, where the most suitable stones are still quarried. The stone is a kind of limestone, composed of lime, clay, and silica, usually of a gray color and of a very fine grain. The stones are found in layers varying in thickness, the thickness required for printing-stones being from 1½ to 5 inches, according to size. They are ground face to face with sand and water, until the surface of both stones is perfectly level. After being carefully polished with a smooth polishing-stone they are ready for use. Writings or drawings may be made on the stone with a fine pen or brush, or drawn on paper having a specially prepared surface, and then transferred to the stone. The methods of printing, consisting of etching out the spaces between the lines of drawing with an acid, inking, etc., are too complicated to be here described. Chromo-lithographs are lithographs in which many colors are printed in one picture. As each color is printed from a separate stone, from three to thirty stones are often used to produce colored pictures.

Liv′er. [AS. *lifer*.] In man the largest gland in the body, situated in the right upper side and towards the front of the abdominal cavity, measuring about 12 inches from side to side, and weighing from 50 to 60 oz. The blood, laden with nutritious matter, has to pass through the liver before it can get into the general circulation; and the chief function of the liver is to secrete or gather the bile from the blood and send it into the gall-bladder, where it is stored up ready to be discharged into the intestines during digestion.

Liz′ard. [Fr., from L. *lacerta*, a lizard.] A term applied to an order of reptiles found in almost all countries, but most plentiful in warm climates. They include the gecko, monitor, dragon, frilled lizard, chameleon, and many others. The body is usually well covered with scales, and is supported usually on four legs. Lizards vary in length from a few inches to several feet. In a great many lizards the tail is almost as brittle as glass. A glove or handkerchief thrown upon one is enough to break it off, but a new one will soon grow out. Their food consists of insects, worms, and small animals; but some prey upon larger animals, and others are herbivorous.

Lla′ma. A most useful South American animal, somewhat like a camel, but smaller and without a hump. The llama lives in flocks among the Andes, and feeds mostly on coarse grasses, mosses, lichens, and shrubs. The ancient Peruvians tamed the llama, and kept great numbers of them for beasts of burden; and it is still put to this use in many parts of South America, especially for carrying goods across steep mountain roads where horses cannot go. The hair of the llama is woven into stuffs similar to alpaca.

Load′stone or **Magnetic Iron Ore.** A hard reddish-black or grey mineral, found in various countries. (See *Magnet*.)

Lob′ster. A well-known crustacean, much esteemed for food. Lobsters are found all round the coasts of Europe, and along the Atlantic coast of the United States north of New York. Immense quantities are sent from America to Europe, packed and preserved in hermetically sealed cans. Lobsters differ in size, weighing from 2 to 15 lbs. Their two large claws are fitted with tooth-like serrations—in the one they are many and sharp, in the other few and blunt—and with these they crush their food, which is chiefly clams, mussels, and other molluscs. They are caught in traps made either of basket-work or of netting, the bait used being dead fish. The shell of the lobster is dark-green when alive, but it turns to bright red when boiled.

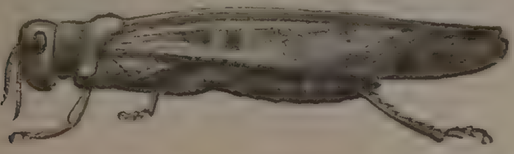
Lock. [AS. *loc* or *loce*.] A well-known instrument for fastening doors, drawers, chests, etc., generally opened by a key. The chief parts of a lock are the bolt or part which locks, and the staple into which the bolt enters when turned by the key. Good locks are distinguished by the number of impediments that can be interposed betwixt the key and the bolt, these impediments being called the *wards* of the lock, which are so arranged as to slip into corresponding grooves of the key. The *tumbler-lock* has two notches on the upper side of the bolt, on which rests the tumbler, which is pressed by a spring into the notches according as the lock is open or shut.

Locomo′tive Steam-engine. The traction engine used on railroads for drawing cars. The first effective locomotive, the "Rocket," was invented by George Stephenson in 1829, though others

had been made earlier. Since then immense improvements have been made and very swift and powerful locomotives built.

Locomobile′. An automobile or motor carriage moved by steam.

Lo′cust. [L. *locusta.*] An insect somewhat like a grasshopper in shape, but with shorter antennæ or feelers and stouter legs. Its hind legs are very strong, enabling it to make long leaps; and its wings are beautifully colored, and from their great length give it the power of sustaining long and high occasional flights. "Locusts fly in great clouds from place to place, and eat up every green thing where they alight." In some parts of Asia and Africa they come in such numbers as to darken the sky in their flight, and they are frequently seen in southern Europe and commit great ravages there. They have also been very destructive in the western United States, where they are known as the Rocky Mountain locusts. The *seventeen-year locusts* live as larvæ in the ground for seventeen years, and afterwards come to the surface and become winged insects. Some species remain underground for a shorter period.



Locust or St. John's Bread. A tree highly valued for its wood. Its leaves are soft and velvety, and it bears clusters of white, sweet-smelling flowers. Its wood is compact and hard, of a greenish-yellow color. The honey-locust tree of America and the West Indies is a large tree, but its wood is not so valuable as that of the common locust. It bears long flat pods full of brown seeds, in a honey-like pulp. Its trunk and limbs are covered with sharp thorns.

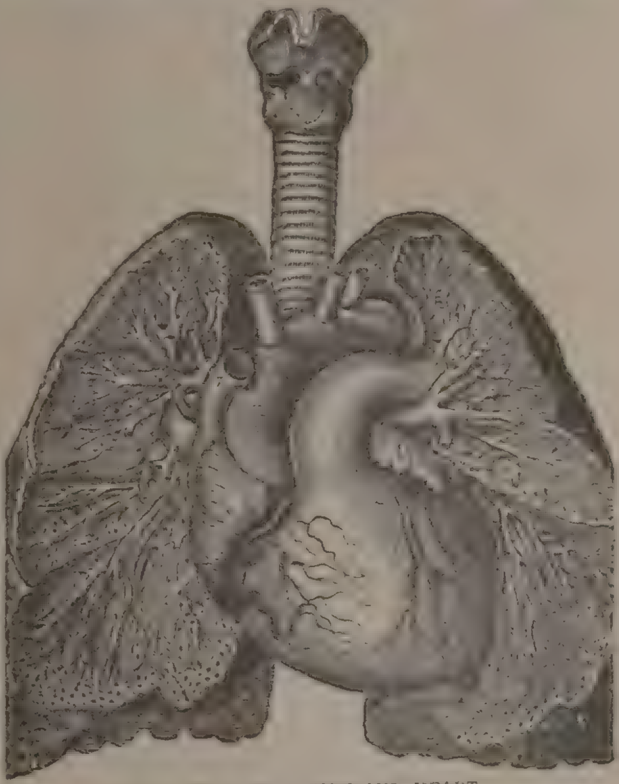
Log. A part of the apparatus for measuring the rate of a ship's motion through the water, consisting of a flat piece of wood, usually in the form of a quadrant, loaded with lead at its circular edge to make it float upright. To it is attached the log-line, which runs freely from a reel, and is marked by *knots* at intervals of five fathoms. The number of *knots* run out during the running of the half-minute sand-glass tells the number of miles per hour which the vessel is making. (See *Knot.*)

Log′wood. [So called because it was brought to Europe in logs.] A tree which grows in Central America, on the Bay of Campeachy, and some of the West India islands. The wood, sometimes called *Campeachy wood*, is of a deep red color internally, and is very extensively used as a dye-wood. Logwood is sometimes used as a medicine.

Lon′gitude. The lines of longitude are a series of imaginary lines which surround the earth at right angles to the equator and pass through the poles. Longitude is measured along the equator east or west from a standard line or meridian, that of Greenwich, England, being usually employed. The length of a degree of longitude decreases north and south from the equator, and vanishes at the poles, where the lines all meet.

Lum′bering. The cutting of forest timber for commercial use. This has become an immense industry in the United States, more than 24,000,000,000 feet being cut annually for various purposes. The white pine has long been the favorite lumber tree, but many others are used.

Lungs. [AS. *lungen.*] The lungs are the organs of respiration. In man the lungs lie in the thorax or chest on each side of the heart—the right lung being a little shorter and broader than the left lung. They are light, spongy bodies, full of little cells which can be filled with air. The blood sent from the right side of the heart to the lungs is of a dark color, and contains much carbonic acid gas; while the blood taken away from the lungs back to the left side of the heart is of a scarlet hue, and contains less carbonic acid gas and more oxygen. The oxygen is taken from the air that enters the lungs, while a nearly equal quantity of carbonic acid gas passes from the blood outwards into the air, and is expelled from the mouth. (See *Heart.*)



THE LUNGS, WIND PIPE AND HEART

Lute. An ancient musical instrument, of the guitar kind. It somewhat resembles the pear in shape, and was played by striking the strings with the fingers. It was in common use till the end of the 17th century, when the guitar took its place.

Lynx. [L. *lynx.*] An animal resembling the common cat, but with longer ears and a shorter tail. It preys on small quadrupeds and birds, and in pursuit of prey frequently climbs to the tops of tall trees. Lynxes are widely distributed throughout Europe, Asia, and North America. The Canada lynx is hunted for its fur, which is prized for robes, muffs, and collars.

Lyre. The oldest known of all stringed instruments, invented, according to old tradition, by the god Mercury. It was the predecessor of the harp, and possessed at first but three strings, which were gradually increased to eleven. It was played upon by a stick of ivory or polished wood. It was used to accompany the voice and was probably of Egyptian origin.

M

Macad′am. Broken stones, about from 2 oz. to 6 oz. in weight each, used as road metal; invented about 1810 by Macadam, a Scottish road contractor.

Macaro′ni. [Ital. *maccheroni*, from *maccare*, to bruise or crush.] A kind of food made from the paste or dough of fine wheat flour, formed in small tubes or pipes. It forms a favorite article of food among Italians. In the neighborhood of Naples whole villages are engaged in its manufacture. It is also made at Marseilles and other places in the south of France, and large quantities are exported to all parts of the world. Macaroni is used in various ways—boiled, served with grated cheese, for thickening soups and for making puddings.

Macaroon′. A favorite cake or biscuit, composed chiefly of the meal of sweet almonds, whites of eggs, and sugar.

Macaw′. A race of beautiful birds found in the tropical regions of America, and included in the Parrot family.

Mace. A staff with an ornamental head, carried before officers of state and magistrates as an emblem of authority; a well-known spice, which forms the inner envelope of the growing nutmeg. It occurs as a fine scarlet net-work, which is stripped off and dried. It is regarded as the most choice of all the spices.

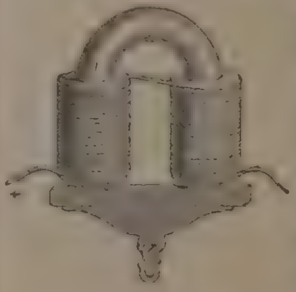
Mack′erel. [Fr., from L. *macula*, a spot.] A well-known salt-water fish, marked with spots on its sides, and much used for food. They move about in vast shoals, and visit the British and American coasts in summer, following after herrings, sprats, or pilchards, on which they prey. They are caught by means of drift nets and shore weirs, but a common mode of capture is by hook and line. The hooks are baited with small pieces of mackerel skin; but the mackerel is a very voracious fish, and will bite at a piece of red flannel, or anything brightly colored or of a glittering appearance. The common mackerel averages 14 inches in length, and weighs about 2 lbs.

Mad′der. [AS. *mædere*.] The name of a very useful red dye obtained from the roots of the madder plant, which is found in the warm parts of the Old and New Worlds. Madder is used by dyers to make a great variety of red tints, and by varying the mordant such colors as madder-orange, madder-purple, madder-yellow, etc., are easily produced. Turkey red used in dyeing cotton goods is a madder color. Alizarin, the red coloring principle of madder, is now made artificially.

Mag′ic-Lan′tern. An optical instrument which, by means of lenses and a lamp or lime-light, enlarges small figures painted with transparent varnish on sides of glass, and exhibits them on a white screen in a darkened room. It is said to have been invented by Athanasius Kircher in 1646. At present transparent photograph slides, plain or colored, are used in the lantern, and much used in illustrating lectures.

Magne′sium. A metal of a silver white color, found in many minerals. It is got by fusion from magnesium chloride. It is very light, easily tarnished, and when lighted burns with a brilliant glow. It may be drawn into wire, filed, bored, or flattened easily. On burning, magnesium unites with oxygen, and leaves a white powder. This is called magnesia (*magnesium oxide*), which, when united with sulphuric acid, makes magnesium sulphate. Magnesium sulphate is found in a mineral spring at Epsom in England, and is commonly known as Epsom salts.

Mag′net. [L. *magnes*, from *Magnesia*.] An ore of iron, "the loadstone," first found at Magnesia, a city in Lydia; now found in different parts of the world, especially in Sweden and in the States of New York and New Jersey. A load-stone or natural magnet has the peculiar properties of attracting iron and some of its ores, and of pointing to the poles. If a loadstone be held near to iron filings, they will cling to it in a cluster. Tacks and small nails may be raised by it, and if the loadstone be a large one it will hold up quite a heavy weight. This power which the loadstone has of attracting iron is called magnetism. Bars of iron or steel may have the properties of the loadstone or natural magnet imparted to them, and hence we have what are called *artificial magnets*. Common iron will not keep its magnetic properties long, but steel will. Artificial magnets are made of various forms, the most common being the bar shape. Powerful permanent magnets are made by placing several thin magnetized bars side by side, fastened firmly together. Such a collection of magnets is called a *magnetic battery*, and is more powerful than a solid bar of the same weight. A bar of soft iron may have the properties of a magnet imparted to it by sending a current of electricity through a coil of wire surrounding it. It is then called an *electro-magnet*. (See *Dynamo*.)



Magno′lia. [*Magnol*, a professor of botany at Montpelier, died 1715.] The name of a tree, a native of North America, India, China, and

Japan, now very widely cultivated, and much admired on account of the beauty of its flowers and foliage.

Mag′pie. [*Mag*, short form of Margaret; and *pie*, from L. *pica*, a magpie.] A bird of the Crow tribe, distinguished from the true crows by its small size, short wings, long tail, and variegated plumage. It is noted for its cunning, is easily tamed, and may be taught to speak a few words. It feeds on snails, slugs, worms, frogs, rats, mice, and the eggs and young of poultry; and when disturbed by any person or animal it keeps up a continual chatter, from which comes the saying to "chatter like a magpie." Magpies are common in Europe and in the northern parts of America.

Mahog′any. The wood of a tree of the same name, a native of Central America and the West Indies. It is a beautiful tree, from 80 to 100 feet high, the trunk being often 5 feet in circumference. The wood is heavy, hard, close-grained, of a reddish-brown color, and susceptible of a brilliant polish. It is used in the making of furniture, and for the inside woodwork of railway cars, sometime solid, but more often as a veneer, or thin layer glued on inferior wood. The wood varies much in value according to the color and beauty of its veins.

Maid′enhair. A species of fern, so called because of its very fine hair-like fronds.

Maize or **Indian Corn.** An important grain of American origin, distinguished by the peculiar arrangement of its large seeds on a long cylindrical cob. It grows on a stalk resembling that of the sugar cane, varying from 5 to 10 feet in height. Its cultivation is simple, and the returns very large, its produce being greater than that of any other grain. Corn-flour is extensively used as food. Maize meal is not well adapted for making bread, but is sometimes mixed with wheaten flour for that purpose. It is also used in the manufacture of starch. In some countries the husks are used in making paper and mattresses, and in stuffing chairs and saddles. More than 2,000 million bushels of maize are grown in the United States annually, much of it being used in fattening swine.

WINE SKIN BOTTLES.

Mal′achite. A mineral of a dark and emerald-green color; a carbonate of copper, much used for ornamental purposes.

Mala′ria. [Ital. *mala*, bad; and *aria*, air.] A poisonous condition of the air most powerful near marshes, producing certain kinds of low fever. It is found to be due to a bacterial microbe, probably largely disseminated by mosquitoes.

Mal′let. [Fr. *maillet*.] A wooden hammer for beating lead, etc., for driving wooden pins, or for using with chisels.

Mal′low. A plant common throughout Europe and in Britain, on waysides and heaps of rubbish. Its soft downy leaves are sometimes used to allay external inflammation.

Malm′sey. [From *Malvasia*, in the south of Greece.] The name of a sweet wine, or the grape from which it is made; originally exported from Malvasia, but now made in other places.

Malt. [AS. *mealt*.] Barley or other grain steeped in water until it begins to germinate, and then dried to stop the growth, thus converting the starch of the grain into sugar. It is used in brewing and distilling.

Mam′mals. [L. *mamma*.] The highest class of vertebrate or backboned animals; so called because they all feed their young with milk formed in their own bodies. In mammals the heart is divided into four chambers, the blood is warm, and the skin has a covering of hair, wool, or bristles.

Man. [AS. *man*.] Man is the chief of mammals, the superior of all animals, the only one which walks erect, and the only one which talks. He excels all other animals not only in body, but in mind. This enables him to reason and to invent, and to have power over the elements and lower animals. The mind is seated in the brain, and man has a much larger brain, in proportion to the size of his body, than any other animal. The human body is made up of the head, trunk, arms and legs. The head contains the brain and the organs of hearing, seeing, smelling and tasting. The trunk is divided into two parts by a partition called the diaphragm. The upper part, called the thorax or chest, contains the heart and lungs; and the lower part, larger than the upper, called the abdomen or belly, contains the stomach, intestines or bowels, liver, and kidneys. The arms and legs are made up of a framework of bones joined together by ligaments.

Man′akin. The name applied to a race of birds common in the tropical parts of South America, of very small size, and noted for the beauty of their plumage.

Manchineel′. [L. *mancanilla*.] A tree which grows in the West Indies and tropical America, noted for its poisonous fruit and poisonous milky juice. The Indians use it for poisoning their arrows. The wood is of fine quality, beautifully veined, and highly valued for cabinet-work.

Man′atee. A genus of marine, plant-eating mammals, known as cow whales or sea-cows, found in the coast waters and river mouths of Africa and South America. They include the Manatee and the Dugong.

Manganese′. A metal closely allied to iron. The important manganese ores are black oxide, brown oxide, and bog manganese. Large deposits exist in Spain, Portugal, and the United States. In Nova Scotia there is an ore very free from iron much used in glass-making. Manganese is largely used in the Bessemer process and as spiegel iron.

Man′go. [Malay.] The fruit of the mango tree, which grows in India and the East and West

Indies. It is very nutritious, and is used as a dessert in hot countries. The green fruit is pickled in the East Indies.

Man′gold or **Man′gel-wurzel.** [Ger. *mangold*, beet; and *wurzel*, root.] A plant resembling beet, but larger and coarser, extensively cultivated as food for cattle.

Man′grove. [Malay.] This tree grows on muddy shores and river-banks in tropical countries. It sends down shoots from its branches, which take root and form new stems.

Manil′a-hemp. [From *Manila*, in the Philippine Islands.] The material obtained from the thread-like fibres of a kind of banana-tree which grows in the Philippine Islands, and largely used for making cables, ropes, and cordage.

Manioc or **Mandioc.** (See *Tapioca.*)

Map. [Fr., from L. *mappa*, a napkin.] A drawing or representation on paper or other material of the surface of the earth or part of it, showing the shape and position of the countries, seas, rivers, etc.

Ma′ple. [AS.] A tree with a great variety of species, many of them found in North America, some in Europe and Asia, and a few in Japan. Some are small shrubs and others are large trees. The red maple, the sugar maple, and the white maple are common throughout the United States. The wood of the red maple is used for inlaying and for making stocks of rifles and fowling-pieces. The sugar maple yields a sap from which sugar is made, and the wood forms excellent fuel, and makes the best of charcoal. Some kinds, called curled and bird's-eye maple, because the grain is twisted or marked like birds' eyes, are used in cabinet-work. The wood of the common maple, a native of many parts of Europe and Asia, is fine-grained, compact, takes a high polish, and is much used by turners, and for carved work.

Mar′ble. [Fr., from L. *marmor*.] Certain varieties of limestone, of sufficiently compact texture to admit of a polish, are known by the name of marble. It is a beautiful stone, usually white, but frequently colored, and marked with stripes, spots, and shades of different tints. As a building stone, marble is valuable for its great durability; and being susceptible of a brilliant polish, is largely used for the purposes of art or architectural ornament. Carrara marble, from quarries in North Italy, and Parian marble, from the isle of Paros, are famous for statuary purposes.

Mar′garin. [Fr.] A solid, fatty, pearl-like substance (of stearin and palmitin) made from olive and other vegetable oils, and also from the fat of some animals.

Mar′igold. A well-known annual plant, bearing a large yellow flower, a native of France and the southern parts of Europe. The French marigold and the African marigold, both Mexican species, have brilliant flowers, and form beautiful borders in flower-gardens. The well-known ice-plants are fig-marigolds.

Mar′joram. [Fr.] A genus of plants of the natural order Labiatæ. The most common kind is the sweet marjoram, which diffuses a sweet and pleasant odor, and is much used in cookery for seasoning.

Marl. A mixture of clay and carbonate of lime, found in Europe, and along the Atlantic coast from New Jersey southward. It is used as a fertilizer.

Mar′malade. [Portuguese *marmelada*; from *marmelo*, a quince.] A preserve made by boiling fruits, such as oranges, pine-apples, and quinces. The most common kind of marmalade is made from bitter or Seville oranges. The rind is cut up into thin strips and boiled with the pulp and an equal weight of sugar, to which half that weight of water is added.

Mar′moset. A small kind of monkey, found only in South America.

Mar′mot. An animal nearly allied to the squirrels, but in form and habits more closely resembling rats and mice. Marmots are natives of the higher parts of the Alps and Pyrenees, and of Central Asia and North America.

Mar′row. [AS.] Fatty matter contained in the hollow parts of the large bones of animals. The whale, the skate, and the turtle have no cavities in their bones.

Mars. The smallest of the planets except Mercury, and the nearest to the earth of the outer planets. It is of nearly 5,000 miles diameter, and about 142,000,000 miles from the sun. It is the only planet the details of whose surface can be seen from the earth, and presents interesting appearances not yet understood.

Marsu′pials. An order of mammals distinguished by the fact that the young are born in the embryo state, and are carried for a time in a peculiar pouch in the abdomen of the mother.

Mar′ten. [Fr. *marte.*] A genus of carnivorous quadrupeds, belonging to the Weasel family. The body is elongated and slim, the ears larger than in the weasel, the tail bushy, the legs short, and the feet have five toes, with long sharp claws. Martens live generally in thick woods, and can climb trees with the greatest ease. They feed on rats, mice, birds, and other small animals. They are widely distributed over Europe, Asia, and North America. The sable marten inhabits Siberia, and furnishes the highly valuable sable fur. The pine marten, or American sable, is found in the northern parts of North America, especially in the thick pine woods. It is much hunted for its fur, which is very handsome and highly prized.

Mar′tin. A genus of birds of the Swallow family. The best known of the American species is the purple martin. It will readily nest in a bird-box, near houses.

Mas′sage. A system of medical treatment by kneading, rubbing, and stroking the muscles, used especially for nervous diseases.

Mas′tiff. A large dog, noted for its strength and courage, often used for watching houses.

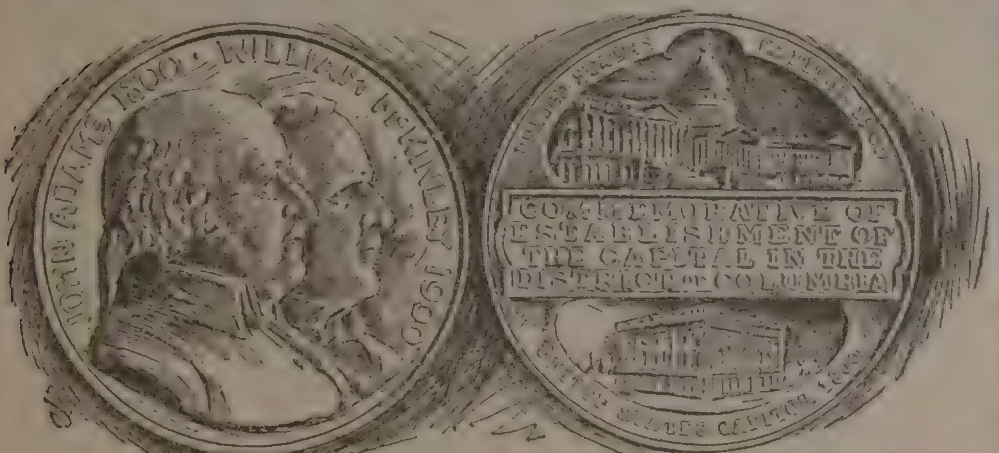
Mas′todon. A kind of large animal allied to the elephant, but larger and with tusks of great length. It was formerly abundant in the United States, and probably lived in the early human period, but is now only found as a fossil.

Match. A small splint of wood, tipped with some very inflammable composition, which bursts into flame upon friction. The first used were brimstone matches, tipped with sulphur. In 1829 an English chemist discovered friction matches, and the making of matches is now an important industry. The best wood for matches is white or yellow pine. The wood is cut into blocks, and the blocks into square splints. The splints are dipped into melted sulphur, and afterwards into phosphorus, mixed with nitre, fine glue, etc. *Safety matches* can be kindled only by rubbing upon the side of the box, on which the phosphorous composition is glued.

Mat′tock. [AS. *mattuc*, a shovel.] A tool of husbandry, used for digging and grubbing up roots of trees and weeds.

Mat′tress. [O.F. *materas.*] A quilted bed, stuffed with hair, wool, or other soft material, instead of feathers.

Ma′vis. [Fr. *mauvis.*] A thrush; properly the song-thrush, not the screech-thrush.


JOHN ADAMS 1800 WILLIAM McKINLEY 1900
COMMEMORATIVE OF ESTABLISHMENT OF THE CAPITAL IN THE DISTRICT OF COLUMBIA

Medal. A circular piece of metal stamped or engraved with a head or design upon it and issued usually to celebrate or mark some great event.

Meer′schaum. [Ger. *meer*, the sea; and *schaum*, foam.] A light, soft magnesian mineral, used in Turkey and Germany in the manufacture of tobacco-pipes.

Mel′on. [Fr., from L. *melo.*] A plant of the Gourd family, to which the cucumber also belongs. It is an annual, with trailing stems, angular leaves, yellow flowers, and bearing a large juicy fruit, which possesses a delicious flavor. It is largely cultivated. The native country of the melon is unknown, but there are numerous varieties found throughout Europe, Asia, and America. The two principal kinds of melons in the United States are the musk-melon and the water-melon (*citrullus*).

Mem′brane. [Fr. *membrane.*] A thin organ, resembling a supple elastic web, serving to secrete a fluid, or to separate, envelop, and form other organs.

Mer′cury. [L. *mercurius.*] A metal of a silvery-white color, also known by the name of quicksilver. It is a liquid at ordinary temperatures, becomes solid at 39° below zero F. and boils at 662° F. Small drops of the pure metal are sometimes found, but its common ore is cinnabar (mercury sulphide), composed of mercury and sulphur. Mercury unites with most metals to form alloys called amalgams. These are very extensively used in the processes of silvering and gilding, in the production of vermilion, and in extracting gold and silver from their ores. Mercury is used in making barometers and thermometers, and in various medicines. Cinnabar, the ore from which mercury is chiefly obtained, is found in Almaden (Spain), Illyria, and the Ural Mountains, and in California, Peru, China, and Japan.

Mer′cury. The smallest planet, and the one nearest to the sun; its distance being 36,000,000 miles. It is 2,992 miles in diameter, and moves around the sun at the speed of 105,000 miles an hour, its year being equal to 88 of our days. Its period of rotation on its axis is not known.

Merid′ian. [L. *meridies*, mid-day.] A great circle thought of as passing through the North and South Poles, and also through any place on the earth's surface. Thus every place has its own meridian, and it is mid-day at any place on the earth's surface when the centre of the sun comes upon the meridian of that place.

Meri′no. [Span.] A breed of sheep with fine wool; originally in Spain, now largely raised in the United States and Australia; also the name of a cloth made from this wool.

Merry-thought. A forked bone between the neck and breast of a fowl; so called from being that which two persons pull at in play. The one who breaks off the longer part has the omen of being first married. Also called wish-bone.

Met′als. [L. *metallum.*] Minerals having certain properties, the chief of which are—1. They are all opaque, and they all have a shiny surface known as the *metallic lustre.* 2. They are good conductors of heat and electricity. 3. With the exception of gold and copper, their color is a grayish white. 4. With the exception of mercury, they are all solids at ordinary temperatures. 5. All metals can be melted, but the temperatures at which they assume the fluid form vary very much. 6. Great weight, most metals being heavier than water. Platinum is more than twenty times as heavy as water. Metals differ from each other in malleability, ductility, and tenacity. A metal is said to be malleable when it can be hammered out into thin sheets. Gold is the most malleable, and next to it in order are silver, copper, platinum, iron, tin, zinc, and lead. Some metals are so brittle that they cannot be hammered at all. When a metal can be drawn out like wire, it is ductile. Gold is the most ductile of all metals. When a metal has the power of holding together under a strain, it is said to have tenacity. Iron is the most tenacious or elastic of all metals.

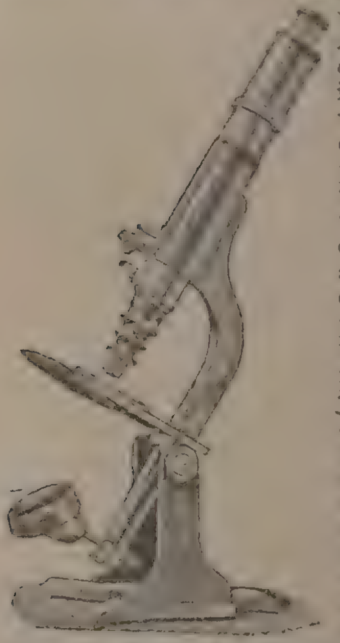
Me′teor. [Fr. *meteore.*] Any natural phenomenon in the atmosphere or clouds; applied particularly to a fiery or luminous body occasionally seen moving rapidly through the atmosphere, and to a fireball; called also a *falling star.* (*q.v.*)

Me′tre. [Fr. *metre.*] Unit of the metric system of length, equal to 39.37 English inches.

Mi′ca. [L. *mica*, a small bit.] A mineral found in granite and most of the other primary rocks. It easily divides into glittering plates of great thinness. It is so transparent that it is used in Siberia, China, Peru, and other countries as a substitute for glass in windows. Mica is sometimes preferred to glass for lanterns, and is also used for doors of stoves, as it is not so liable to break with sudden changes of temperature.

Mi′crophone. An apparatus for magnifying very faint sounds, by variation of electrical resistance. It forms the basic principle of the carbon telephone transmitter.

Mi′croscope. [Gk. *mikros*, small; and *skopein*, to see.] An instrument for viewing objects which are too small to be seen with the naked eye. A simple microscope consists of a tube having one convex lens, which magnifies the object; while a compound microscope has two convex lenses in a tube, one of which is called the object-glass, and the other one the eye-glass. In the compound microscope the thing looked at is first magnified by the object-glass, and this is again magnified by the eye-glass. The microscope is an interesting and wonderful instrument, and by its means many living things invisible to the naked eye are revealed. The microscope is also applied to the study of rock structure by grinding down the stone to thin sections. Preparations for the microscope are preserved on glass slips (3x1 in.) covered by very thin glass fastened by Canada balsam or shellac.



Mignonnette′. [Fr. *mignonnette.*] An annual plant and flower prized for its delicate and agreeable fragrance.

Milk. [AS.] A white fluid secreted in the mammary glands of the females of all mammals. When examined under the microscope, milk is seen to consist of a clear fluid, filled with round floating balls of fat of very minute size, each one enclosed in a separate film or thin skin of albumen. When milk has stood for some time these balls of fat rise to the surface, and form a layer of cream. When cream is churned the cases of the balls are broken, and the fat runs together and makes butter. Skimmed milk is that which remains after the cream is removed. Condensed milk is prepared from that of the cow, sweetened with sugar and boiled down until the water is out of it, thus forming a thick, sweet paste, which is sealed up in tin cans.

Mil′let. [Fr., from L. *milium.*] The name of several kinds of grasses bearing a great number of small round seeds used as food. The common millet is a native of the East Indies, but is also cultivated in the warmer parts of Europe, Africa, the United States, and the West Indies. The seeds are ground up into meal for bread. Certain kinds of millet bear seeds used as food for cattle, poultry, and cage-birds.

Milk′weed. A family of plants found in North and South America, which are full of milky juice. The seeds are covered with a silky down, which has been mixed with cotton and woven into cloth. The root is used in medicine.

Milky Way. A broad, luminous belt encircling the sky, and shown by the telescope to be made up of a countless multitude of suns, so immensely distant as to be very dimly visible. There are probably more than a thousand millions of suns in this wonderful belt.

Mimo′sa. [Gk. *mimos*, imitator.] A genus of leguminous plants, including among its species the sensitive plant, so called from its seeming to imitate the sensibility of animal life.

Mine. [Fr. *mine.*] A subterraneous work or excavation for obtaining metals, metallic ores, or other mineral substances. The deepest mine is the Spensenberg, near Berlin, 4,175 feet.

Min′eral. [It. *minerale.*] A natural body destitute of organization or life; a substance found in or on the earth which is neither animal nor vegetable.

Mineral Waters. Waters or springs impregnated with mineral substances.

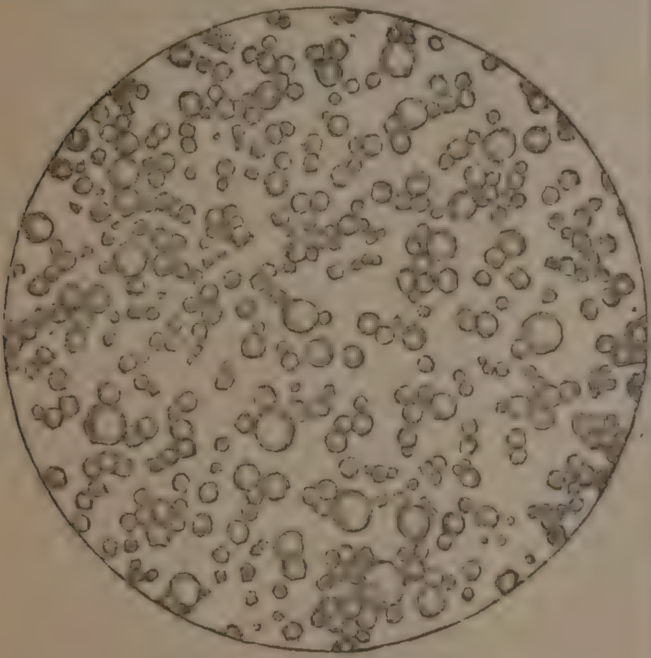
Mink. A quadruped of the Weasel tribe, often called minx, and valued for its fur, which is of a chestnut-brown color. It is found in the cold parts of North America, Europe and Asia, living on the banks of rivers and lakes, and feeding on small birds, fishes, frogs, and mussels.

Min′now. [Fr. *menu*, small.] The name applied to several species of very small fishes found in fresh water ponds and rivers. Minnows average from 2 to 3 inches in length, and feed on aquatic plants, worms, insects, and small snails. They are generally caught by a small hand-net, and used as bait to catch other fish.

Mint. [AS., from L. *mentha.*] The name of a strongly-smelling plant, with flowers in whorls. Numerous species are known, widely distributed over the world, but the most important are spearmint and peppermint. Spearmint is the common mint found in gardens, and is largely used in making mint-sauce and for flavoring soups. The oil of mint is distilled from the leaves, and from the oil are made the essence of mint and mint-water. Peppermint is cultivated chiefly for the oil which it yields, so much used for flavoring confectionery and for making cordials and essences. Essence of peppermint is made by mixing the oil with alcohol, and is used in medicine.

Mi′rage. An optical illusion often seen in hot climates, especially in deserts. Travelers apparently see a broad lake with surrounding trees, where only desert sand exists. It is a phenomenon of refraction.

Mir′ror. [Fr. *miroir*.] A plate of glass lined at the back with a brilliant metal, so as to reflect the image of any object placed before it. Mirrors are made by coating the back of a sheet of plate-glass with an amalgam of mercury and tin-foil. In ancient times mirrors were made of polished metal. Ordinary mirrors have flat surfaces, but there are also *convex mirrors*, which cause the rays of light to diverge and decrease the size of the reflected image, and *concave mirrors*, in which the rays are reflected to a focus and the image magnified. Beyond the focus it is inverted.



MILK UNDER THE MICROSCOPE

Mist. [AS.] Moisture visible in the air; rain in very fine and almost imperceptible drops. (See *Fog*.)

Mis′tletoe. [AS. *mistelta*.] An evergreen plant that grows on the branches of many kinds of trees. In winter it is covered with small white berries. This plant was held in great veneration by the Druids and is now used in the Christmas festivities.

Mi′tre. [Fr., from Gk. *mitra*.] A crown or head-dress worn by archbishops and bishops during solemn church services.

Mitre-joint. The joint made by the ends of two pieces of wood fitted together at a right angle, as in the corners of a picture-frame. The mouldings are usually sawn in a *mitre-box*, the sides of which have saw-cuts through them at an angle of 45° to guide the saw in cutting.

Moc′casin. A venomous snake of the United States, resembling the rattlesnake, but without a rattle. The name is sometimes given improperly to the copperhead. Also the shoe of buck skin formerly worn by the Indians.

Mock′ing-bird. A bird which gets its name from its habit of imitating the songs of other birds It is a kind of thrush, found only in North and South America and the West Indies. Its form is graceful, but its plumage is not very handsome. Its own song, which is sweet and pleasing, is heard mostly at night. During the day it imitates the songs of other birds, passing from one to another with the greatest ease, now warbling like a canary or blue-bird, then cackling like a hen or screaming like a swallow. It can imitate various other sounds, and readily learns to whistle a tune. Mocking-birds feed chiefly on berries and insects, are easily tamed, and live happily in cages if caught when young.

Mo′hair. [Fr. *moire*.] The hair of a kind of goat found in the neighborhood of Angora, in Asia Minor, and now also at the Cape and in California. The covering of this goat is a long, soft, silky, pure white hair or wool, which is woven into varieties of camlet, shawls, and trimmings, and in France into a fine kind of lace.

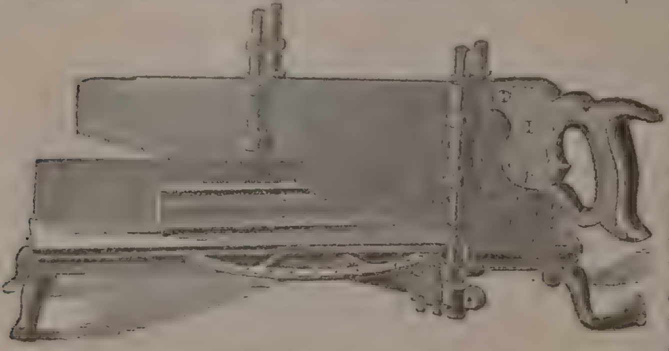
Molas′ses. [L. *mellaceus*, honey-sweet.] The thick liquid of the juice of the sugar-cane, which separates from it in the process of manufacture. (See *Cane Sugar*.)

Mole. [O.E. *mold warp* = thrower-up of mould or earth.] The mole is found in Europe, Asia, Africa, and North America; but is not found in Ireland or in the Western Isles of Scotland. From its habits and mode of life it is one of the most interesting of mammals. It lives underground, and seldoms sees the light. Its food consists of earthworms and the larvæ of insects. It has a long cylindrical body, very short limbs, and a pointed snout. Its forearms, hands, and claws are shaped into strong tools for scraping, digging, and shoveling away the earth. The eyes are completely hidden in the fur, and though the sense of sight is probably very imperfect, the senses of hearing and smelling are very acute. Moles in making their tunnels damage the roots of plants, but they are very useful in destroying a vast number of grubs, which would otherwise feed on and do more damage to the roots than the moles.

Mollus′ca. [L. *mollis*, soft.] The animals included in this group have soft, inarticulated bodies, usually inclosed in a shell, the body covered with a sensitive contractile skin, kept moistened by a viscid fluid which exudes from it. In one large division of molluscs (gastropods) the under surface of the body is covered by a broad fleshy disc or foot, on which the animal glides slowly along. Snails and slugs possess this foot. Of the shell-covered molluscs some live in univalve, others in bivalve, or multivalve shells. To the bivalves belong, oysters, mussels, and cockles; to the univalves snails, whelks, cowries, limpets, etc. The shells of the former class are joined by a hinge, and the inhabitant has the power of opening and closing the valves at will. Many of the inhabitants of the univalve shells have a horny or shelly plate attached to their bodies, which serves the purpose of a door when the animal retires within its house. This is well illustrated in the common periwinkle.

Mon′ey. [L. *moneta.*] Stamped metal, generally of gold, silver, or copper, used in traffic, or as the measure of price. The term *money* is now applied to whatever serves as a circulating medium, including bank notes and drafts, as well as metallic coins.

Mon′key. [Ital. *monicchio.*] The name of a family of animals found in the tropical parts of America, Asia, and Africa. They resemble man more than any other animals, both in their outward form and in their skeletons, and they sometime act very much like man. They live mostly in trees, which they climb with great ease. Their food consists of fruits, nuts, and insects. They are cunning and mischevious, and, if the higher apes be included, are the most intelligent of the animals below man. Many of the American apes have prehensile tails, by the aid of which they can swing from branch to branch.



MITRE BOX AND SAW

Mon′ogram. [Gk. *monos*, alone; and *gramma*, a letter.] One, two, or more letters interwoven as a cipher or abbreviation of a name, and used in seals, coats of arms, etc.

Monsoon′. [Ital. from Arab. = a time or season.] The wind that blows over the Indian Ocean from the north-east from October to April, and in the opposite direction during the rest of the year.

Month. [AS. *monadh*, from *mona*, the moon.] The twelfth part of the calendar year—popularly the space of four weeks. The *calendar* month has 30 or 31 days, except February, which has 28, and in a leap year 29; the *lunar* month is 29 days 12 hrs. 44 min. 2.684 sec; and the *sidereal* month is 27 days 7 hrs. 43 min. 11.545 sec.

Moon. [AS. *mona.*] The globe or satellite which moves round the earth and reflects the light of the sun upon it. In form it is an almost perfect sphere of 2,163 miles in diameter, and revolves at a mean distance from the earth's centre of 238,840 miles. The moon presents as large a surface to the eye as the sun, but it is really many million times smaller, and looks as large only because it is so much nearer. It moves round the earth in a nearly circular orbit in a little less than a month. The time occupied by the moon in passing from one star to the same star again is called a *sidereal* month. For every revolution in the moon's orbit it rotates once on its axis, so that one side of the moon is always invisible to the earth. At times, however, owing to its vibratory motion, we see a little more than the side which usually faces the earth. When the moon is between the sun and the earth, it is invisible, and on becoming visible is called "the new moon," and when the earth is between the moon and the sun, the whole surface becomes visible, and in this state we have what is called "full moon." The interval from new moon to new moon again—that is, the time occupied by the moon in passing from the sun round to the sun again—is called the *synodic* month. It is longer than the sidereal month, its mean value being 29.53 days nearly, and this is the length of the *ordinary lunar* month. From "new" to "full" the moon increases in apparent size, and then begins to decrease in size, until it returns to the condition of the new moon. In the phases before and after new moon a faint illumination of the part not directly lighted up by the sun is visible. This is called the "earth shine," and is due to the reflection of light received from the earth. An eclipse of the moon takes place when it gets into the shadow of the earth, and an eclipse of the sun when the moon comes between the sun and the earth. To the naked eye the surface of the moon presents a mottled appearance, some parts being light and others dark. Viewed through a telescope the surface appears to be covered with mountains, valleys, and plains, like the surface of the earth; only in the moon everything is barren and desolate, like the country around volcanoes, and there are no seas, lakes, or rivers. The harvest moon is the full moon that occurs nearest the autumnal equinox (Sept. 23). (See *Eclipse.*)

Moose. The largest of the Deer family, equal in size to the horse, and standing very high. Its broad antlers weigh from 50 to 70 pounds. It is found in northern New England and Canada, and closely resembles the elk of Europe.

Mor′dant. [Fr., from L. *mordere*, to bite.] A substance, such as alum, for making colors firm and permanent. In *gilding*, the size used to make gold-leaf adhere.

Moroc′co. [*Morocco*, in North Africa.] A fine kind of leather made from goat-skin. It includes imitation French kid, brush kid, glazed kid, pebbles, straight-grained goat, and oiled goat. (See *Leather.*)

Mor′tar. [L. *mortarium.*] Sand with slaked lime and water, mixed thoroughly into a paste, and put between stones and bricks to fasten them together. (See *Cement.*)

Mor′tise. [Fr. *mortaise.*] A hole or hollow cut in one piece of timber to receive the end of another piece made to fit, called the *tenon*. The junction of the two pieces is called a *mortise-joint*, and is much used in putting together the frames of houses, and in making doors and shutters.

Mosa′ic. [L. *musivum opus*, mosaic work.] Ornamental work formed of small pieces of colored marble, precious stones, or glass, laid in figures or patterns, attached by being bedded in cement.

Mosqui′to. [Span., from L. *musca*, a fly.] A species of gnat that abounds in marshes and woods, and whose sting is very painful. They are very widely distributed, being found in the coldest as well as in the hottest countries. A long proboscis or sucker projects from the head, with several little bristles or lancets sharper than the finest needle. These bristles prick the skin, and the insects draw up the blood through the proboscis, and a poisonous juice is squirted into the wound, which causes great itching, and sometimes a bad sore. It is supposed also that the microbe of malaria is thus implanted in the blood of man. Mosquitoes feed chiefly on the juices of plants, rarely on blood.

Mosses. (*Musci.*) A class of small flowerless plants, with simple branching stems and numerous narrow leaves. There are about 3,000 species, growing chiefly in cool and rocky regions, and also in bogs and swamps. Cold swamps are everywhere being filled with sphagnum and other mosses, whose remains accumulate, and are in time condensed to peat—a valuable fuel where wood and coal are scarce.

Moth. [AS.] An insect like a butterfly, but without thickenings on its antennæ, seen mostly flying about at twilight or during night. There are many kinds, and they vary in form, size, and color. The clothes-moth, the larvæ of which eat holes in clothing, carpets, and furs, is among the smallest of moths.

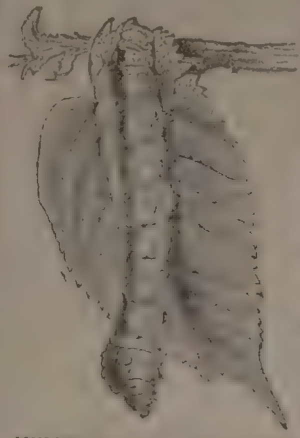
Moth′er-of-pearl. The hard, silvery, brilliant substance, called nacre, which forms an internal layer in several kinds of shells. Most of it is got from the shells of the pearl oyster, brought in considerable quantities every year from the East Indies, South America, and the Pacific Islands, and manufactured into knife handles, buttons, studs, and ornaments. It is also used in inlaying and for *papier-mache* work.

Mound Builders. The ancient Indians who erected the earth-mounds, so common in the Mississippi and Ohio Valleys. They are thought to have been the ancestors of some of the present tribes, especially those of the Southern States.

Mouse. [L. *mus.*] A small and well-known quadruped, found in almost all countries, and infesting dwelling-houses, granaries, and fields. The common house-mouse is a timid and harmless animal, but often does much mischief. The field-mouse and the harvest-mouse are the pests of farmers, causing much destruction of growing grain.

Mul′let. [Fr., from L. *mullus.*] A fish, often found in river-mouths and near the coast, which eats mud for the organic *debris* it contains, and is highly esteemed as food. The chief kinds are the red mullet and the gray mullet.

Mul′berry. [AS.] A genus of trees bearing a succulent mass of fruit of a purplish-black color and fine aromatic flavor. The fruit is much esteemed for dessert, and a pleasant light wine and an excellent preserve are made of it. The leaves of the mulberry are used for feeding silkworms.


MULBERRY LEAF AND WORM.

Mule. [AS., from L. *mulus.*] An animal which is a half-breed between the male ass and female horse. The head, ears, and tail resemble those of the ass, but in bulk and height the mule is nearer the horse. It is very sure-footed, and of great value for traveling in mountainous countries. Mules are largely used as beasts of burden in Spain, Portugal, Italy, and Spanish America; and in some of the southern States of North America they are employed for work on plantations. In recent wars mules have been found most useful transport animals.

Mul′lion. [Fr. *moulure.*] The upright bar or division between the lights of windows, screens, and panels in Gothic architecture.

Mum′my. The preserved body of a human being or animal. In Egypt the bodies were preserved by a process of embalming; and multitudes of mummies exist thousands of years old. In ancient Peru the same effect was produced by sun-drying. Dried bodies are also found in the Cliff Dwellings of the Western United States.

Mus′cle. [Fr., from L. *musculus.*] The fleshy parts of the body, which have the power of contracting and of moving the joints with which they are connected. Muscles are *striated* and voluntary, or *non-striated* and involuntary. They are composed of fibres laid side by side, forming bundles, which are attached to the bones by tough whitish strings called sinews or tendons. The various bones of the body are moved by about 400 muscles.

Mush′room. [Fr. *mousseron.*] A fleshy plant belonging to the fungi, with a short white stalk and a flat or rounded head, umbrella-shaped, which grows up in pasture-fields sometimes in a single night. Many kinds can be eaten, and some are used in making ketchup.

Musk. [L. *muscus.*] A substance with a strong and persistent odor, obtained from the male of the musk-deer, which inhabits the mountainous parts of Central Asia. Musk is one of the strongest of all perfumes, and is much used by perfumers.

Mus′ket. [Fr. *mousquet.*] The name formerly given to the common gun in the hands of soldiers, which was then discharged by means of a lighted match, but in which a spring-lock is now employed. (See *Rifle.*)

Musk-ox. A ruminating animal, between the sheep and the ox in character, found in the northern parts of America and even in the northernmost part of Greenland. Warmth is obtained from its very thick hair. When fat the flesh is well flavored, but musky in smell.

Musk-rat. The name of two distinct species of animals, one found only in America, much hunted for the sake of its fur, from 400,000 to 500,000 skins being annually imported into Britain; the other common in Europe. Both exhale a very strong odor of musk.

Mus'lin. [Fr. *mousseline*, from Mosul in Asiatic Turkey, where this cloth was first made.] A fine, thin kind of cotton cloth, of a light and soft texture, and not woven so compactly as calico.

MUSSEL.

Mus'sel. [L. *musculus.*] The name applied to several common bivalve shell-fish, of which the common sea-mussel is the most important, and is largely used as bait for deep-sea fishing. In some districts of Europe it is used as an article of food. Near Rochelle, in France, there are large "mussel farms," and hundreds of people are employed in planting and gathering the mussels.

Mus'tang. The name given to the small wild horses of Texas, California, Mexico, etc.

Mus'tard. [L. *mustum.*] The seeds of the mustard plant ground to powder and used as a seasoning for meat. The mustard plant is an annual, about 3 feet high, with sweet-smelling yellow flowers and seeds in little pods.

Myrrh. [L. *myrrha.*] A pleasant-smelling gum-resin obtained from the sap of the myrrh-tree, which grows in Arabia and Abyssinia. It is used in medicine as a tonic for disorders of the digestive organs, to cleanse wounds, and as a tooth powder when the gums are spongy.

Myr'tle. [L. *myrtus.*] A tree or evergreen shrub, with beautiful white flowers, shining leaves, and pleasant smell. The ancients considered it sacred to Venus, and her temples were surrounded by groves of myrtle trees.

N

Nail. [AS. *nægel.*] A pointed piece of metal, with a round or flattened head, used for driving into wood or other material for the purpose of holding separate pieces together. Formerly nails were made by the hand; complicated machinery is now employed in their manufacture. Nails vary in size and shape according to their different uses. They are now usually made of wire.

Nail. The horny scale on the fingers and toes of man. (See *Hoofs* and *Claw.*)

Nankeen'. [*Nankin*, in China.] A brownish-yellow cotton cloth made from a kind of cotton which grows in China. Imitations of this cloth are made in Great Britain and America, and are dyed yellow instead of being made of the cotton of that color.

Nap. [AS. *hnoppa.*] The soft downy surface of cloth; so called because, before it is dressed, it is composed of many little loops or knobs, which are afterwards cut and smoothed.

Naph'tha. [Pers. *nafata*, to exude.] A volatile bituminous liquid, of a strong peculiar smell, and very easily set on fire. When occurring naturally it is called rock oil or crude petroleum, and it is also obtained in the refinement ofpetroleum. It is used for illumination and to dissolve varnishes, etc. *Coal naphtha* is obtained by the distillation of ,coal tar, *boghead naphtha* from coal, and *wood naphtha* from wood.

Nap'kin. [Fr. *nappe*, a tablecloth; and *-kin*, little.] A small cloth; a cloth used for wiping the fingers and mouth at table.

Narcis'sus. [Gk. *narkissos.*] A class of bulbous plants to which daffodils belong, cultivated for the sake of their fragrant and beautiful cup-shaped flowers, which possess narcotic properties.

Nar'whal. A marine mammal belonging to the Dolphin family, chiefly found in the Arctic seas. It is generally from 20 to 30 feet long, and is armed with a horny projection from the upper jaw, 6 to 10 feet long, and harder and whiter than ivory. It has sometimes two of these horns or tusks, but though thus armed is a very peaceable animal.

Nastur'tium. [L. *nasus*, the nose; and *torqueo*, to twist, in allusion to its pungent taste causing pain.] A plant cultivated both for ornament and use. It is a kind of cress, with white or yellowish flowers and a warm, pungent taste. The flowers are used in salads, and the seeds as a substitute for capers.

Nau'tilus. [Gk. *nautilos*, sailor, or shell-fish supposed to have a membrane which served as a sail.] A genus of shell-fish having a spiral shell, chambered with simple partitions perforated in the centre, concave towards the outlet of the shell. The outer chamber is the largest, and contains the body of the animal. The head of the animal has many simple tapered arms or tentacles. Four kinds are found living in the tropical Pacific, but there are many fossil kinds. It creeps along the bottom of the sea, and does not sail on the surface, as was formerly supposed.

Neb'ula. A vapory patch of seemingly gaseous matter seen in the heavens among the stars, and sometimes of immense dimensions. Many of the supposed nebulæ have been shown to be clusters of very distant stars, but others are proved by the spectroscope to be made up of luminous gas. Great numbers of them exist.

Nee'dle. [AS. *nædl.*] The sewing-needle is a small instrument of fine steel wire, pointed at one end, with an eye at the other to receive a thread. In needles for sewing-machines the eye is at the pointed end. The *magnetic needle* is a small piece of steel, pointed at both ends, and used in the mariner's compass. By its magnetic properties it is attracted and directed to the poles.

Nep′tune. The planet most distant from the sun, its distance being about 2,746,000,000 miles. Its diameter is about 37,300 miles, and its year equals 164.6 of our years. It has one known satellite, which revolves around it in a direction opposite to that of the satellites of the other planets.

Nerves. [L. *nervus.*] All the organs of the body are connected by nerves—each a bundle of nerve fibres enclosed in a special sheath—either with a great mass of nervous matter called the brain, or with a long thick nerve called the spinal cord, which runs down the centre of the back-bone. Delicate white threads or nerves pass from the brain through little holes in the skull to the ears, eyes, nose, mouth, etc. Long but very fine nerves extend from the spinal cord to all parts of the body. By the nerves sensations or feelings are transmitted to the brain. If the nerves going from the tip of a finger to the brain are cut, we can no longer feel anything with that finger. Again, if any part of the skin is touched, the sensation passes along a nerve to the spinal cord, and then up that great nerve trunk to the brain. But the nervous system does more than merely receive sensations. All the movements of the muscles are directed and governed by the nerves, and similarly the action of all the other organs of the body is under the control of the nervous system.

Net. [AS.] A fabric made of hemp, flax, or jute twine, and sometimes of cotton and other materials, worked into open meshes, and used in capturing fish, birds, butterflies, and small quadrupeds. Many kinds of nets are used by fishermen, but those most in use are the seine, drift, and trawl nets.

Net′tle. [AS. *netele.*] A genus of plants covered with extremely fine, sharp hairs, which pierce the skin when touched, and inject into the wounds an acrid juice, often causing much inflammation and pain. The fibre of the nettle is very strong, and in some countries it is woven into cloth. The stalks and leaves are used in some parts of England for the manufacture of *nettle-beer*.

New′el. The upright post about which the steps of a circular staircase wind; hence, in stairs having straight flights, the principal post at the foot of a staircase, or the secondary ones at the landings.

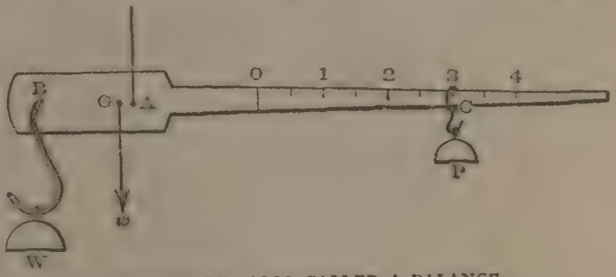
Newt. Any one of the several species of small aquatic salamanders; but the term is more commonly applied to the animals which inhabit ponds, wet ditches, and other damp places.

Nick′el. A metal discovered in 1751. It is of a silvery-white color, ductile, malleable, stronger than iron, and almost as hard to melt. Nickel is found in Russia, Norway, Germany, New Caledonia, Canada, and the United States. It does not tarnish by exposure to moist air, is very susceptible of magnetism, and magnets are made of it. Nickel is used for plating other metals, to which it gives a beautiful silver-like surface that keeps them from rusting. Nickel is used with steel wrought into armor plates for warships. German silver is an alloy of nickel, copper, and zinc, and some white compounds used for small coins are similar alloys.

Night′ingale. [AS. *nihtegale.*] A small European bird, rather larger than the hedge-sparrow, of a rich russet-brown color, and noted for its vocal powers. It sings in the evening, and the sweetness of its song is celebrated by the poets.

Ni′tre. [Fr. *nitre.*] Saltpetre. A white crystalline salt, of a cooling, slightly bitter taste, unalterable in the air, and insoluble in alcohol. It is used in the manufacture of gunpowder, in the production of nitric acid, in medicine, as a fertilizer, and for preserving meat.

Ni′tric Acid. The most important oxide of nitrogen. Its chemical formula is $N_2 O_5$. It forms valuable compounds with most of the bases, and is useful also for its powerful oxidizing properties.



STEEL YARD, ALSO CALLED A BALANCE.

Ni′trogen. [Gk. *nitron*, nitre; and *gennao*, I produce.] The gaseous element which forms nearly four-fifths of the atmosphere. When alone or uncombined it does not possess any very active properties. In the air it serves to dilute the oxygen, which by itself would be too strong in its effects on life. Nitrogen is a colorless and transparent gas. It has neither smell nor taste, and it will not readily combine with other elements. It is very slightly soluble in water, and it is neither combustible nor a supporter of combustion, a lighted taper plunged into a jar containing nitrogen being at once extinguished. It forms many most important compounds, such as nitric acid, ammonia, and cyanogen.

Ni′tro-gly′cerine. A liquid appearing like a heavy oil, colorless or yellowish, and consisting of a mixture of several glycerine salts. It is produced by the action of nitric acid on glycerine in the presence of sulphuric acid, and is terribly explosive. When compounded with siliceous earth it forms *dynamite*, and with wood, *lignose*.

Nut. The fruit of certain trees consisting of a hard shell enclosing an edible kernel, differing in size from the beech-nut to the cocoanut—a piece of metal with a grooved hole, screwed upon the end of a screw-bolt.

Nut′meg. [*Nut*, and L. *muscus*, musk.] The kernel of the nut of a tree which grows in the East Indies, much used in cookery because of its pleasant taste and smell.

O

Oak. [AS.] The name of a noble genus of trees, sometimes styled the monarch of the woods. A large proportion of forest trees are oaks, of which there are about 300 different kinds, spread over nearly the whole of the northern hemisphere, except the extreme north. Some oaks shed their leaves every year, and some are evergreens, and the leaves are alternate, but often variously lobed. The timber of the oak is hard and tough, and has been used from the very earliest times as the best material for shipbuilding. It is also employed in architecture, cabinetmaking, millwork, and coopering, and the bark is used in tanning and dyeing. It bears a well-known nut, called the acorn, which is contained in a small woody cup.

Oats. [AS. *ate.*] The grain of a corn-producing grass, which differs from wheat and barley in the loose arrangement of its spikelets on the stalk, forming what is termed a *panicle.* The oat is a hardy plant, well able to bear cold and moisture. Oatmeal is largely used in Scotland and in North America, and forms a very valuable article of food. Oats are excellent food for horses and cattle.

Ob′elisk. A tall, tapering, four-sided pyramid, cut off at the top in the form of a flat pyramid. Obelisks, made from single stones, of great height, stood before the temples of Egypt, their sides closely carved with hieroglyphic inscriptions.

O′cean. The great body of water which occupies five-sevenths of the area of the earth's surface, and surrounds all the continents. It is divided into the Atlantic, Pacific, Indian, Arctic, and Antarctic oceans.

O′celot. A member of the cat family, smaller than the leopard and the ounce. It is about 3 feet long, and is found in America from Texas to Brazil, and in Sumatra. It climbs trees and feeds on birds and small animals.

O′chre. [Fr. *ocre.*] A fine kind of iron clay, either red (hematite) or yellow (limonite), used with size for painting.

Octupus. (See *Devil Fish.*)

Oil Well. A well sunk to underground beds of petroleum. It consists of iron pipes sunk into the earth, following a drill which cuts an opening downward. Some of these wells are sunk to a great depth, the total number in the whole earth reaching probably 100,000. The oil sometimes flows out and sometimes is obtained by pumping.

Oils. [Fr., from L. *oleum.*] Greasy substances expressed or drawn from various animal, vegetable, and mineral bodies, as olive *oil*, whale *oil*, rock *oil*, etc. They are used for food, for solvents, for anointing, lubrication, illumination, etc. The mineral oils are varieties of petroleum. The vegetable oils are of two classes—*essential oils* and *natural oils*, which in general resemble the animal oils and fats. Most of the natural oils and the animal oils and fats consist of ethereal salts of glycerine, with a large number of organic acids, principally stearic, oleic, and palmitic, forming respectively stearin, olein, and palmitin. Mutton tallow, beef tallow, and lard are rich in stearin, human fat and palm oil in palmitin, and sperm and codliver in olein. Oils are classified according to their properties, and include—(1) non-drying oils, as almond, mustard, olive, etc.; (2) drying oils, as linseed, walnut, poppy, hemp etc.; (3) train and fish oils, as seal, sperm, whale, cod, etc.; (4) vegetable fats, as palm oil, cocoanut oil, etc.; (5) animal fats, as lard, butter, tallow, etc.; and (6) waxes, as palm-tree wax, bees-wax, etc.

Ol′ive. [L. *oliva.*] A tree or shrub with small oblong leaves, of which there are several species, the most important being the common olive, long cultivated in the south of Europe and Asia for its fruit. The olive has been much improved by cultivation. The oil is used in salads, in the arts, and in medicine, and the fruit for dessert purposes. Olive wood is very hard and is employed for cabinet-work.

Om′elet or **Om′elette.** [Fr. *omelette.*] A food compound, made with eggs beaten up with flour, etc., and fried in a pan.

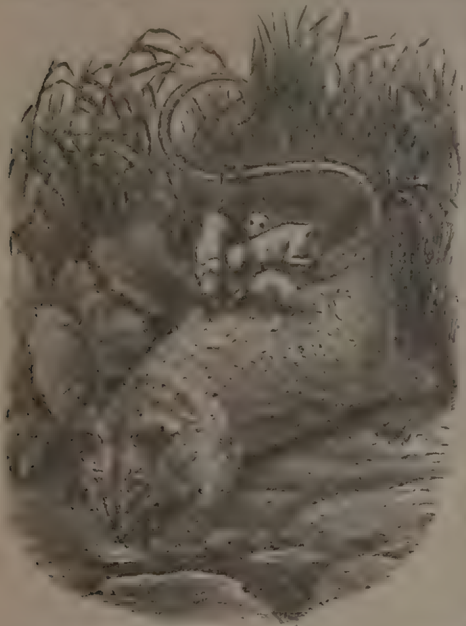
On′ion. [Fr., from L. *unio.*] A genus of plants, which includes also the garlic, leek, and shallot. The onion is very extensively cultivated, and grows best in a rich and rather moist soil. Its root bears a round or oblong bulb, widely in use as a pot-herb and as a table food. It is very nutritious, and easily digested.

O′nyx. A variety of chalcedony with some resemblance to agate. It is made up of alternating parallel bands of different colors, and was used by the ancients in making cameos, the figures being cut in the white layers, while the darker layers formed the background.

O′pal. [L. *opalus.*] A mineral consisting of silica with a small admixture of alumina. Precious opal presents a fine play of colors, due to its great number of minute fissures, and is highly esteemed as a gem for setting in rings, brooches, and other ornaments. The finest opal comes from Hungary and Mexico. Common opal is semitransparent, white, yellow, green, red, or brown, and has no play of colors.

Op′era-glass. A small double telescope, with concave lenses of low powers, for seeing clearly rather than magnifying objects at no great distance, such as scenery and buildings, and the interiors of operas, theatres, etc.

O′pium. [L. *opium*, Gk. *opion*, poppy-juice.] A vegetable extract which is the most active of all narcotics, and a valuable medicine. It is obtained from the dried juice of the opium-poppy, which grows wild in many parts of Asia, and is now largely cultivated in India, Persia, and China, and to a considerable extent in some parts of Europe. Much of the opium raised in India is sent to China, where it is largely used for smoking, with baneful effects. As a medicine it relieves pain, allays irritation of the nervous system, and produces sleep. Morphia is the active principle, and the quality of the opium is judged by the quantity of morphia it contains. Laudanum, a crude preparation of opium in spirits of wine, is the form in which opium is very largely used.



Opos′sum. The name of several kinds of marsupial animals, found only in America. The best known is the common Virginia opossum, found all over the United States. In size it is about as large as a cat, but in shape more like a rat. It has short legs, a very long tail covered with scales instead of hair, except at its base, and a sharp rat-like nose. In some opossums the pouch is absent. In several species the young are carried about on the back of their mother, and with their tails they cling to her tail, which is curved over her back.

Or′ange. [Fr. and Ital., from Pers. *naranj*, with *n* dropped.] An evergreen tropical and semi-tropical tree, seldom rising above 25 feet in height. The fruit is usually round, and consists commonly of ten pulpy parts enclosed in a leathery rind. The flowers, which are of a delicate white color, appear in summer, but the fruit is not ready for picking till the following year. Hence flowers and fruit in various stages may be seen on the trees at the same time. There are numerous varieties of the orange, which is cultivated in all the warmer regions of the earth. In the United States it is raised largely in Florida and California. The blood orange has a reddish juice. The mandarin orange is small, is thought to be of Chinese origin, and is counted a distinct species. The Seville or bitter orange is grown in large quantities in Spain, and imported into Great Britain and the United States for making marmalade. The rind is made into candied orange-peel. The leaf, the flower, and the rind of the fruit all yield volatile oils. The scent of *eau de Cologne* is due chiefly to oil distilled from the orange flower, while the rind of the bergamot orange yields *essence of bergamot*, largely used in perfumery.

Orang′-outang′. [Malayan = man of the woods.] An animal of the ape kind, found in Borneo, Sumatra, and Malacca. It is over 4 feet high, is reddish-brown and closely resembles man in many respects. It dwells only in forests, and moves rapidly from tree to tree.

Or′chid. A family of plants, distinguished by the singular forms of their flowers, which in some cases resemble a bird or an insect. They are prized for their beauty, fragrance and singularity.

Ore. The mineral from which metals are extracted. Metals usually exist in combination with oxygen, sulphur, or other elements; often with other metals. They are extracted from those compounds by the use of heat and various chemical processes.

O′sier. [Fr. *osier*.] The popular name of a species of willow, the long twigs of which are best adapted for basket-making and other wicker-work. (See *Willow*.)

Os′mose. The process which takes place when two fluids of different densities are separated by an animal membrane or by unglazed earthenware. They pass through the partition and mingle with each other, through the action of a kind of molecular attraction.

Os′prey. [L. *ossifraga*; *os*, a bone; and *frango*, to break.] A bird of the family *Falconidæ*, the bald buzzard, fishing-eagle, or fish-hawk, a large bird of prey, living upon fish, which it takes by darting upon them with great rapidity and true aim.

Os′trich. [Fr., from L. *avis*, a bird; and *struthio*, an ostrich.] The largest of all birds, attaining an average height of from 6 to 8 feet. It is a native of the sandy plains of Africa and Arabia. It has long and very strong legs, and only two toes, and is remarkable for its speed in running, and valued for its feathers. Ostriches live chiefly on fruits, grain, leaves, tender shoots, snails, and insects. They swallow stones to grind their food with in the gizzard, and have been known to gulp down pieces of iron, glass, leather, and other hard things. An ostrich egg is very large, weighing about 3 lbs., and is thus equal to about two dozen ordinary hen's eggs. The shell is thick and strong, and is much employed by the South African tribes for water-vessels. The ostrich is now domesticated in South Africa, and bred on farms for its feathers, oil, eggs, etc.

Ot′ter. [AS. *oter*.] A genus of carnivorous aquatic quadrupeds, included in the Weasel family. This animal is larger than others of that family, being often 4 feet long, and differs from them in living mostly in the water. Its paws are webbed for swimming, and its food is chiefly fish. Its fur is short, thick, fine, and quite handsome. Otters are found in almost all parts of the world. The American or Canadian otter is most plentiful in Canada, where thousands are killed every year for their furs.

Owl. [AS. *ula*.] A raptorial bird that howls or hoots at night. The owl has a short, stout form, downy feathers, and a large head with a flat face. The eyes are round and staring, and have a fringe of stiff feathers around them; and the bill is short, strong, and hooked. During the day owls hide away in trees, caves, and old buildings; and in the dusk of the evening, when they see better than in broad daylight, they fly around looking for game. Their food consists chiefly of rats, mice, moles, squirrels, and other small quadrupeds; but they sometimes feed on other birds, and some of the smaller kinds eat moths, beetles, and other insects. They catch their prey with their claws, and swallow it whole at one gulp. There are many kinds—*barn*, *eared*, *hawk*, *horned*, *screech*, and *snowy* owls.

Ox. [AS. *oxa*.] The general name for the different species and varieties of the ruminant quadrupeds belonging to the genus *Bos*. The species is distinguished by having smooth, hollow, persistent horns, growing on a bony core, by having the body thick and heavy, and the tail long, terminated by a tuft of hair.

METAL BURNING IN OXYGEN.

Ox′ygen. [Gk. *oxus*, acid; and *gennein*, to make.] A gas without color, taste, or smell, forming that part of the air which supports life and flame. It is also the principal component part of water. Oxygen readily combines with almost every other element. Not only does it form about one-fifth of the atmosphere, but it is also found in a great number of solid and liquid compounds. It has been estimated that this element alone forms about one-half by weight of the crust of the earth, being thus the most abundant of all the elements. When we see any substance burning, we may be certain that what we call *oxidation* is going on—that is, that the matter of the coal, or the candle, or the gas, or whatever it may be, is combining with the oxygen of the air, and in the act of doing so is producing heat and light.

Oys′ter. [Fr. *huitre*, from Gk. *ostreon*.] A genus of bivalve molluscs, much esteemed for food. Oysters are distributed very widely, and principally in the seas of warm and temperate climates. They are found on gravel and sand, in estuaries, and on the sea-coast, sometimes attached to rocks, trees, etc., at depths varying from the surface to seventeen fathoms. (See *Clams*.)

O′zone. [Gk. *ozein*, to smell.] A gaseous substance obtained from oxygen; so named from its peculiar odor, which resembles that of weak chlorine.

P

Pace. [Fr., from L. *passus*, a step.] The distance passed over in walking one step, estimated at 2½ feet, but in measuring distances by stepping it is extended to 3 feet.

Pad′lock. A hanging lock with a clasp which turns on a hinge at one end, and, passing through a staple or link, receives the bolt through an opening in its other end.

Paint. [Fr., from L. *pingere*, to paint.] All paints are made up of the substance which gives the color, usually called the pigment, and that with which the color is mixed. Pigments are mostly made from minerals, but some are got from vegetables and some from animals. Paints are mixed either with oil or water, and are therefore called oil-paints or water-colors. Oil-paints are usually mixed with linseed oil, but sometimes some kinds of nut oils are used. Water-colors are mixed with water and a little glue or gum.

Palan′quin. A covered litter used in China, India, etc., borne on the shoulders of men.

Pal′ette. [Fr., from L. *paletta*, dim. of *pala*, a spade or shovel.] A little thin, oval board, or slab of ivory or porcelain, on which a painter mixes his colors, and which he holds by a thumb at one end.

Palm. [L. *palma*.] The name of about 1,000 species of plants growing in warm climates. Their stems are erect and slender, often lofty, and generally without branches, crowned at the summit with a tuft of large radiating leaves. Most of them are noted for the variety and utility of their products. (See *Cocoa*; *Date*.)

PALANQUIN.

Palmetto. The common name of the palm trees which grow in the southern United States. There are several kinds, but the cabbage palmetto, extensively cultivated in the south-eastern States, is the principal one. It grows to a height of from 20 to 30 feet. Its leaves are used for thatching buildings, and for making hats, baskets, mats, etc. As the ship-worm does not attack its wood, the timber is used for wharves and other woodwork under water.

Pam′pas Grass. A tall grass which covers much of the pampas, or great plains of South America. Its leaves, 6 or 8 feet long, hang gracefully over, while from the centre arises the flower-stems, 10 to 14 feet high. It is much cultivated in the north as an ornamental plant.

Pan′nier. [Fr., from L. *panarium*, a breadbasket.] A wicker basket ; one of a pair of baskets slung over a horse's back, for carrying fruit or other light articles.

Pan′sy. [Fr. *pensee*.] A name applied to the varieties of *Viola tricolor*, etc., cultivated in gardens under the name of *heart's-ease*. (See *Violet*.)

Pantaloon′. One of the chief actors in a pantomine, who plays the part of a clown. He dresses in wide, long, garments—a kind of close long trousers, worn by males, extending from the waist to the feet.

Pan′ther. [Gk. *panther*.] A fierce flesh-eating African quadruped of the size of a large dog, spotted like a leopard, but darker in color. The Puma is often called the American Panther. (See *Leopard*.)

Pan′tomine. A theatrical exhibition in which there is no conversation, the plot being indicated by gestures and scenic effect. Its characters are taken by adepts in mimicry and gesticulation.

Papaw′. A small fruit tree of the south and southwest United States. Its fruit is a pod 3 or 4 inches long and an inch thick, with two rows of large flat seeds. It has a yellow skin when ripe, and looks something like a banana. Its flesh is softer and sweeter than the banana.

Pa′per. [L. *papyrus*.] Paper may be described as thin layers of fine vegetable fibre. It is made from the following materials: linen and cotton rags, refuse flax and hemp, jute, esparto grass, straw, soft wood, and waste paper. In America so considerable a quantity of wood is used that it is said the spruce is being depleted from many forests for this purpose. Esparto grass which grows in the south of Spain and the north of Africa, is the staple fibre used in Britain in the production of *machine-made* printing and ordinary writing-paper. Writing and printing papers can be made on the same machine, but their composition and character are totally different. *Printing-papers* require to be comparatively soft, open, and spongy, so as to absorb the ink freely ; whereas writing-papers require to be stiff, hard, and non-absorbent. The best *writing-paper* is made wholly from rags, but very good is made from combinations of rags, wood, straw, or esparto. Names or devices or *water-marks* are put on the paper while it is traveling, in the form of half-moist pulp, upon the "wire" of the paper-making machine. A light spider-ringed roll, covered with wire-gauze, and having the name or device projecting from its surface, is made to revolve upon the top of the pulp, leaving its stamp or impression upon it ; the water at the same moment being immediately withdrawn, leaves the depression permanent, and thus water-marks are simply thin portions of the sheet, varying in outline as letter or device stamps itself upon the pulp on the machine. The webs of paper from the machine are then cut into sheets of different length and width as required, and examined for imperfections. The recent development of book illustration requires a highly-finished paper, which is passed through a slight mist or fine spray and then run through a super calender. Writing-paper is glazed under heavy pressure between sheets of copper or zinc.

Pap′ier-ma′che. [Fr. *papier*, paper ; and *mache*, mashed or chewed.] Paper mashed into pulp, and after being mixed with size or glue formed into various shapes by molds—as tea-boards, trays, and ornamental articles—and japanned when dry.

Par′achute. [Fr. *parer*, to guard ; *a*, against ; and *chute*, a fall.] An instrument in the form of an umbrella, which enables a person, by its resistance to the air, to drop down safely from a balloon.

Par′affin. Fr., from L. *parum*, little ; and *affinis*, related to.] A white substance of the nature of wax. It is got from shale, coal-tar, petroleum, etc., and is *unattacked* (hence its name) by such powerful oxidizing agents as nitric and chloric acid. The lighter and more volatile portions of petroleum are used as solvents for gums, fats, resins, etc.; and the less volatile portions are used for illuminating and for lubricating, or are converted into *vaseline* or *paraffin* wax, from which candles are made.

Parch′ment. [Fr., from L. *pergamena ; Pergamos*, in Asia Minor, where it was first made about B.C. 190.] The skin of a sheep or goat dressed and prepared for writing on. Parchment used for covering drums is made from the skins of asses, calves, or wolves, those of wolves being the best.

Par′rot. [Fr. *perroquet*.] The type of a large group of tropical birds, of numerous species, noted for their beautiful color and powerful hooked and projecting bill, which is used for crushing seeds and fruits. Parrots use their bills as well as their claws in climbing trees, and use their feet to carry food to their mouths. Those usually kept as pets are the South American parrot, and the gray parrot, with scarlet tail, from West Africa. The latter is noted for its tameness, mischievousness, and power of imitating sounds. It is easily taught to whistle and to speak. Parrots live to a great age, instances being on record of these birds attaining an age of seventy or more years.

Pars′ley. [Fr., from Gk. *petros*, rock ; and *selinon*, a kind of parsley.] An aromatic herb, with finely-divided leaves, used for seasoning soups and for dressing dishes. It is a native of the south of Europe.

Pars′nip or **Pars′nep.** [L. *pastinaca*.] An aromatic herb, cultivated for the sake of its root, which resembles a carrot, and is highly nutritious.

The flesh of cattle fed on parsnips is excellent, and the butter of dairy cows fed on them is superior to that produced by other kinds of winter feeding.

Par′tridge. [Fr., from Gk. *perdix*.] A family of birds which includes also the quail. The common or gray partridge is found throughout Europe. Its flesh is much liked, and the bird is the delight of the sportsman. The red-legged partridge of southern Europe is found also in Asia. In the United States the quail is often called by the name of partridge. The partridge of New England is the ruffled grouse; the spruce partridge is the Canada grouse.

Pas′sion-flower. A beautiful climbing plant, remarkable for the elegance and singular form of its flowers, which resemble "a crown of thorns." The roots and leaves are noxious, and are used in medicine.

Pea. [AS., from L. *pisum*, a pea.] A garden and field plant of many varieties, with a papilionaceous or butterfly flower, and fruit in a legume or pod. It is supposed to belong to the south of Europe, and has been cultivated in the East from remote antiquity. It is now one of the most common of garden plants, and is largely grown by market-gardeners, who find it a most profitable crop. As an article of food peas are very valuable, containing a large percentage of *casein*, which is a flesh-forming principle.

THE OSTRICH.

Peach. [Fr., from L. *Persicus* = *Prunus Persica*, the Persian tree.] A well-known tree and its fruit, a native of Persia, largely cultivated throughout Europe and the United States. The peach tree is of medium size, with finely-serrated leaves and beautiful flowers, which appear before the leaves and diffuse an agreeable odor. The fruit is one of the most exquisite and delicious of temperate climates. In several of the United States there are immense orchards of peaches, and large quantities are sent to the northern markets, while the canning and drying of the fruit form an important industry.

Pea′cock. [AS., L. *pavo*, a peacock.] One of the most beautiful of birds, of a nature similar to the pheasant, with a tail of very long, bright feathers. It is elegant in form and graceful in its movements, with a splendid crest or tuft on the head, while the feathers of its tail are of an emerald green, purple and gold, studded with richly-shaded eye-like markings, and are capable of erection. The female birds are smaller, and not nearly so handsome, being of a sombre brownish plumage, and presenting a striking contrast to the brilliant appearance of their mates. The cry of the peacock is very harsh and loud. Wild peacocks are still plentiful in many parts of India, and in Java, Sumatra, etc., and in these places hunting them forms a favorite amusement of the sportsman. The feathers of the peacock are used for trimming clothes and fans, and for ornamental brushes. Its flesh was eaten in ancient times. The Romans used to think it a great delicacy, and the emperors had dishes served at their feasts made entirely of the brains and tongues of peacocks. But peacocks are not much eaten now, as their flesh is not so good as that of the turkey and other fowls.

Pea′nut. The fruit of a leguminous plant growing in warm countries—also called ground nut and earth nut. The plant is a trailing vine, with small yellow flowers. After the flowers fall the stem lengthens, bends downward, and the seed-pod on its end forces itself into the ground, where it ripens. Peanuts are raised in immense quantities in western Africa, South America, and the southern United States. They are used for food, and yield an oil resembling olive oil.

Pear. [AS., from L. *pirus*, a pear-tree.] The pear-tree is very largely cultivated for the sake of its fruit. The tree grows wild in many parts of Europe, and is now cultivated in all temperate climates. It sometimes attains a height of 40 feet, with a trunk from 2 to 3 feet in diameter. The varieties of pears are very numerous, and though many of them are of little consequence, more than two hundred at the present day are enumerated as fit for the table, and new varieties are being added every year. Pears are preserved by canning, like peaches. The wood of the pear-tree is hard, fine-grained, of a yellowish color, and susceptible of a brilliant polish. It is largely used by turners, and sometimes dyed black and used by cabinet-makers for ebony.

Pearl. [O.E. *perle*.] A white, hard, smooth, shining substance, found in some shell-fish, especially in the pearl-oyster, river-mussel, and certain univalves. It is highly valued for its beauty, and used as a jewel. The shells are lined with a secretion of extremely thin semi-transparent films, and in due time layers of considerable thickness are formed, which gradually harden into the material known by the name of *nacre*, or mother-of-pearl. Besides the pearl lining of the shells, rounded portions of nacre or *mother-of-pearl* are found in the flesh of the oyster. These are supposed to be formed by the intrusion of some foreign body, such as a grain of sand, around which layers of nacre are deposited one after another, as many as from ten to twelve round pearls of different sizes being often found within one shell. The best pearls are found off the coast of Ceylon, in the Persian Gulf, on the coast of Australia, and on the Pacific coast of America. The pearl-fishing season lasts from four to six weeks. A fleet of about 250 boats is engaged in the fishery, each boat having a crew of thirteen men and ten divers, five of the latter being employed in diving whilst the other five are resting. The work is done very rapidly, as the divers cannot remain much more than a minute under water. Each diver is let down from the boat by a rope, weighted with a stone. The usual depth is from 60 to 70 feet. The most valuable pearls are those which are perfectly round; but these are very scarce, and secure high prices. They are used to form the centre of necklaces. Pearls have been prized as articles of decoration and ornament in all ages of the world. Cleopatra is said to have owned two very large and beautiful ones. Many splendid pearls are owned by the different crowned heads of Europe; but the Shah of Persia is said to have the finest.

Peat. [For *beat;* AS. *betan*, to make *better*, to mend (a fire). Same root as *better*.] A vegetable substance found amidst much moisture, as in marshes and morasses, and made up of roots, stems, and fibres in every stage of decomposition. When cut and dried it is often used for fuel in many places where wood and coal are scarce. The use of peat as fuel in the distillation of Scotch whiskey gives it its peculiar flavor. Charcoal made from compressed peat is superior to wood charcoal, and is capable of being used for smelting iron.

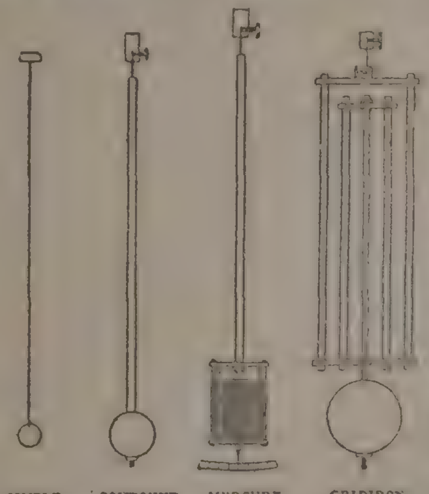
Pec′cary. An American animal allied to the hog, but smaller. There are two species. One—about 3 feet long—extends from Arkansas to Patagonia, the other from Central America to southern Brazil. The latter is extremely pugnacious and its herds are dangerous to meet. Even the jaguar retires before several of these animals banded together.

Pel′ican. [L. *pelicanus*.] A large web-footed water-bird, remarkable for its long, large, flattened bill, to which is attached a bag or pouch for holding the fish taken for food. Pelicans live along the shores of seas, lakes, and rivers. They hover over the water in search of prey, and plunge upon it when it appears, storing it in their pouch until it is full, when they go to some lonely place to bring it out at leisure to eat or to feed their young. Pelicans are natives of the eastern parts of Europe, and of many parts of Asia and Africa. The American white and brown pelicans abound on the Florida coast in winter, but breed on the North American lakes.

Pen. [L. *penna*, a feather.] An instrument for writing with a fluid ink. In ancient times, pens were made out of reeds; but after paper came into use they were made from quills, generally those of the goose and swan, and for extremely fine writing those of the crow. The manufacture of pens from steel was commenced about the beginning of the nineteenth century. Machinery is now largely used in the manufacture of pens, but the finer qualities are finished by hand labor. An ordinary steel pen has to go through some sixteen different processes; while the gold pen, which is incorrodible with ink, and very largely manufactured in the United States, goes through no less than forty-five different processes.

Pen′cil. [L. *penicillus*, a small tail or brush.] A pointed strip of black lead, colored chalk, or slate, usually enclosed in a slight rod of wood, for drawing and writing; but the term is also applied to small hair brushes used by artists, and it was to these that the name was originally given. The best lead pencils are now made in the United States, the purest black lead or plumbago being found there. The wood used for pencils is invariably that of the Virginia or Florida cedar. Colored pencils are prepared by the use of various chalks instead of graphite. The chalk is reduced to powder, mixed with a little hot melted wax, and then pressed and cut into strips of the size required. Slate pencils are thin strips of slate cut out and afterwards rounded. The strips are sometimes cut very thin and put into wood casings like lead pencils.

Pen′dulum. [L. *pendulus*.] An instrument consisting of a weight suspended from a fixed point, and free to swing to and fro by the alternate force of momentum and gravity. It is used to regulate the movements of clock-work and other machinery. The principal kinds in common use are—the simple, the compound, the mercury, and the gridiron pendulums.



Pen′guin. A genus of swimming birds included in the Auk family. Penguins exist in large numbers in the Antarctic seas, and along the southern coasts of Africa and South America.

Their front wings, which are without true quills, are too short for flight, and are used as fins or paddles in swimming under water. On shore these birds present a singular appearance, standing erect in long regular lines, resembling files of soldiers. The plumage of the neck is valued for collars and tippets, and large numbers are slaughtered annually.

Pen′ny. [AS.] An English coin, formerly of copper, now of bronze, worth one-twelfth of a shilling. In the New Testament a silver coin of the value of about 7½d. In the United States the name *penny* is often given to the *cent*, a coin of half the value.

Pennyroy′al. A kind of mint found in Europe and very fragrant. The United States pennyroyal is not a mint, but its scent is like that of the European plant and it has the same uses. A tea is sometimes made from it, and its oil is used to drive away flies and mosquitoes.

Pepper. [AS., from L. *piper*.] A common kind of spice, the dried berry of a climbing shrub which grows wild in the East Indies, but is now cultivated in most hot countries. The peppers of Malacca, Java, and especially of Sumatra, are the most esteemed. The berries are about as large as peas, and grow in clusters of twenty or thirty, somewhat like a bunch of currants, each berry containing a single seed. *Cayenne pepper*, first brought from Cayenne, in South America, is made from the pod of the capsicum plant, an entirely different kind of shrub from that which bears black pepper. The pod is green at first, but bright scarlet when ripe, and this gives the pepper its red color.

Pep′permint. A small herb, of a strong spicy odor, much used for flavoring. This, with the spearmint and the pennyroyal, is used in medicine for its stimulant and carminative properties. Others of the mint family are the horse-mint, the brook-mint and the corn-mint, the latter smelling like decayed cheese.

Pep′sin. [Gk. *pepsis*, cooking; *peptein*, to digest.] The active agent in the gastric juice of many animals. For use in drugs it is obtained from the glandular layers of pigs' or calves' stomachs.

Peram′bulator. An instrument for measuring distances, made up of a wheel with an apparatus of clock-work, and a dial-plate upon which the distances traveled are shown by an index; also the name given to a child's carriage, pushed forward by a person walking.

Perch. [Fr., from Gk. *perke*.] The name of several species of fishes of the genus *Perca*, frequenting the fresh waters and coasts of temperate and tropical regions. The fresh-water perch is widely distributed in lakes, ponds, and rivers in Europe, Asia, and North America. It is greenish yellow on the back, and bright yellow on the sides, which are marked with from five to seven blackish bands. The perch is very voracious, devouring smaller fishes, insects, worms, etc. It can exist out of water for a considerable time.

Per′fumes. [Fr., from L. *per*, through; and *fumare*, from *fumus*, smoke.] Scents made from sweet-smelling substances. They are obtained chiefly from plants, but some are got from animals. Vegetable perfumes are made from flowers, herbs, spices, seeds, gums, certain fruits and nuts, and various woods. Perfumes of animal origin are obtained from the musk, ambergris, civet, and castor. Dry perfumes, such as incense and *sachet* powders, are simply gums, resins, dried herbs, etc., pounded or ground to powder. Liquid perfumes are mostly distilled from the different parts of plants. Such perfumes are called essential oils. But the perfumes made from flowers, such as are used on the handkerchief, are mostly made, not by distillation, but by maceration and absorption.

Per′iwinkle. [AS. *pinewincla*.] A sea-snail or small shell-fish, found in abundance between tide-marks on rocks or adhering to sea-weeds. Periwinkles feed on sea-weeds, and are often collected and boiled in their shells, from which they are afterwards extracted and used for food.—Also a trailing herb of the genus *Vinca*.

Per′ry. The fermented juice of pears, prepared in the same way as cider, and used as a beverage.

Persim′mon. A tree bearing a small, rounded fruit in the United States; also in Japan. The fruit is yellow and pulpy, and when unripe is highly astringent, but is sweet and palatable after being frosted. A kind of liquor is made from persimmons.

Pet′rel. [Perhaps from the apostle Peter's walking on the sea.] A genus of sea-birds allied to the gulls. The best-known species is the stormy petrel, well known to seamen as Mother Carey's chicken. The appearance of these birds is considered to presage a storm, and they are often seen during storms at sea skimming over the surface of the water as if walking on it. Their food consists of small marine animals and seeds of sea-weeds, and they appear fond of fat or grease, for which they will follow in the wake of ships for great distances.

Petro′leum. [L., from Gk. *petra*, a rock; and *oleum*, oil.] Rock-oil, an inflammable liquid which exudes from the earth in various parts of the world. Petroleum has been known since the most ancient times, but it is only recently that its importance as a commercial production has been discovered. It is found in great quantities in the United States and at Baku, Russia, and in smaller quantities in several other countries. The oil is generally got by sinking deep holes, called wells, into the earth. In some of these wells the oil rises up and flows over, being forced out by a kind of gas; but in others the oil has to

ENGLAND
NEWFOUNDLAND
IT IS A MATTER OF TIME AND WORK; I SHALL GET IT YET; ALL I NEED TO DO IS TO KEEP ON TRYING.

THE MARVEL OF THE 20TH CENTURY

Wireless telegraphy is one of the triumphs of the New Century. It has harnessed the electricity of the earth and sky for its uses. It promises to be of great value and may replace the cable and wire in carrying messages. Patient and painstaking experiment has at last brought to William Marconi fame and honor and made his name a household word to be associated with those of Franklin, Morse and Field, his predecessors in this work.

EDISON PERFECTING THE FIRST PHONOGRAPH

The invention of the phonograph is probably the most marvelous invention of recent years. The discovery of the principle of vibration in metal, due to sound of voice, is said to have been due to chance. Edison saw the possibility and achieved additional fame.

be pumped out. In the oil-region in Pennsylvania there are now several thousand wells, some of which are more than a thousand feet deep. There is always a good deal of what is known as natural gas associated with petroleum. This gas is made up of carbon and hydrogen, and burns very brightly. It is carried in pipes to neighboring towns and used for domestic and manufacturing purposes. At one time Pittsburg used 500,000,000 cubic feet daily in its factories and houses.

The oil from the wells flows into large tanks, from which it is carried in iron pipes to the shipping places and places where it is to be refined or purified. There are more than two thousand miles of these pipes laid in the Pennsylvania oil-region, and they reach from there to Philadelphia. At the refineries the oil is distilled and separated into oil for illuminating purposes, commonly called kerosene oil; naphtha, used in making oil-cloths, and sometimes as a burning fluid; benzine, used in making paints and varnishes; gasolene, used for making gas and for mixing with coal gas. (See *Naphtha* and *Paraffin.*)

Pew′ter. [Ital. *peltro.*] A common and very useful alloy, consisting mainly of lead and tin, improved in hardness and color by the addition of a little antimony, bismuth, and zinc. Britannia metal is a kind of pewter, made of tin and antimony, with a little zinc and copper. It is harder than common pewter, has a very fine silver-looking appearance, and is largely used for making tankards, coffee-pots, tea-pots, soup-tureens, and other table dishes.

Pheas′ant. [L. *phasianus.*] The name of a family of birds, natives of Asia. The common pheasant, has been domesticated, but not successfully in this country. Some species are remarkable for their great beauty of plumage.

Phlox. A very ornamental North American genus of plants, bearing handsome flowers, of which many attractive varieties have been produced by the florist.

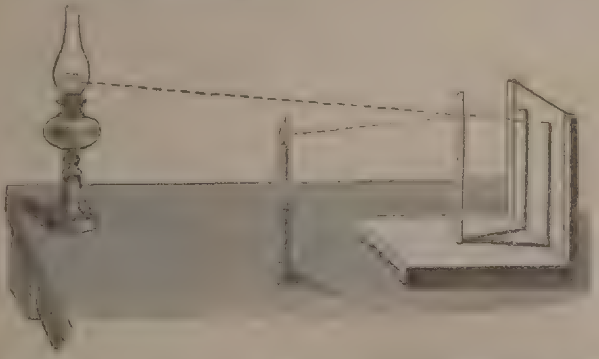
Phœ′nix. A fabulous bird of antiquity, eagle-like in form, and with gold and crimson plumage. It was said to live 500 years in the desert, then return to Egypt and build a nest. In this it was consumed, and a new bird sprang from its ashes. The word is now used in a metaphorical sense, to indicate the springing of the new from the old.

Phon′ograph. [Gk. *phone*, a sound; and *graphein*, to write.] The phonograph, invented by Mr. Edison in 1877, is an instrument which mechanically records and reproduces articulate human speech, song, etc. Speaking in front of this instrument, a thin iron plate having a blunt steel point or pen fixed at its centre is made to vibrate; the steel point by means of an ingenious mechanism, chronicles the vibratory movements by indenting a sheet of tin-foil, wax, or paraffin, with which it is brought into contact. The slip thus marked is then removed, and may be sent to any distance, or kept for a number of years, when it has only to be placed on a similar phonograph, and the operations reversed, in order to produce similar vibrations, which exactly reproduce the voice and the words originally spoken. The message can be read off as often as desired, until the indentations are worn out.

Phos′phate rock. A mineral, of organic origin, found in South Carolina and Florida, and to a smaller extent in other parts of the world. It is dug up and ground, and used for a fertilizer, it being rich in fertilizing properties.

Phos′phorus. [Gk. *phos*, light; and *phoros*, bringing.] A yellowish element resembling fine wax, which must be preserved under water. It is easily set on fire, and gives out a faint light in the dark. It is used for the tips of matches. It is found in the seeds of plants and in the nerves, bones, and other parts of the animal body. Phosphate of lime is abundant in bones, and from these phosphorous is now obtained.

Photog′raphy. [Gk. *phos*, light; and *graphein*, to write.] The science or art of taking representations of objects by the action of light on a prepared surface. The surface, consisting of metal, glass, paper, or other suitable substance, is prepared by being coated with collodion or gelatine, and sensitized with the chlorides, bromides, or iodides of silver, or other salts sensitive to light. The picture obtained in the camera by means of exposing one or other of these sensitive surfaces to the light cannot be seen when the plate is removed, but by pouring over it a mixture of ferrous sulphate or pyrogallic acid it comes out little by little. This is called developing the picture. Any excess of unchanged sensitive salt is then dissolved off with sodium hyposulphite or other suitable reagents, and in this way the negative image is fixed, from which any number of positive prints may be taken, which are washed, toned, fixed, and then mounted.—*Photogravure*, a print from a copper or steel plate. The picture is produced on the plate by photography, and bitten in with acid instead of engraving.—*Photo-lithograph*, a lithographic picture or copy from a stone prepared by the aid of photography.



Photom′eter. An instrument for measuring the relative intensity of light, or for comparing the intensity of two lights. The unit is the light of a candle. The incandescent electric light is measured in this way, and the glass bulbs are marked 8-12-16-32 candle power.

Phy′salia. The Portuguese man-of-war, a singular ocean animal, consisting of a pear-shaped air-sac, with a handsome crest, which floats on the surface, and from which depend a large number of long tentacles. The sac is 3 or 4 inches long, and some of its tentacles are 30 feet long.

Phy′sics. The class of sciences which include the forces or properties of matter and motion, as electricity, magnetism, light, heat, and gravitation.

Pianofor′te. A musical instrument consisting of a number of tightened wires of different lengths and thicknesses, struck with small hammers worked by keys; so called because it can produce both *soft* and *loud* tones.

Pig′eon. [Fr.] A genus of birds found in all parts of the world, there being nearly 500 different kinds. Their wings are strong, and they can fly great distances. The wild pigeon, or *passenger pigeon*, is about the size of a turtle-dove, but with a long wedge-like tail. There are numerous varieties produced by domestication, including the *fantail*, the *tumbler*, the *pouter*, etc. One of the most important of these is the *carrier pigeon*, which is capable of flying long distances at rapid speed. These birds are noted for their love of home, and they will find their way back even when taken hundreds of miles away. For this reason they have been used from the most ancient times for carrying letters, and it is from this that they get their name.

Pike. The common name of a family of well-known fresh-water fish, abundant in the temperate parts of Europe, Asia, and America. They are strong fish, rapid swimmers, and the most voracious of fresh-water fishes, living mostly on other fish. They possess a long, sharp jaw or snout, which is like a pike or spear. The common pike occurs in the rivers of Europe and North America, and is accounted exceedingly wholesome.

Pil′chard or **Sardine.** A fish resembling the herring, but smaller, thicker, and rounder, found in abundance off the coasts of Devon and Cornwall, England. Most of the pilchards landed there are salted and sent to Spain, Italy, and France. They are packed in hogsheads, each containing about 3,000 fishes, and from 12,000 to 15,000 hogsheads are annually exported.

Pile. [AS. from L. *pilum*, a pike.] A large pointed log of wood driven into the earth to support the foundations of a building, or used in engineering operations, such as making drains, bridges, and roads. Piles are driven into the ground by machines called pile-drivers, worked usually by steam. A heavy weight is raised to a considerable height between two tall posts, and then let fall on the head of the pile.

Pin. Pins were formerly made by hand, and the heads were put on separately, but solid-headed pins are now made by machines. The pin-machine, an American invention, patented in England in 1824, makes the whole pin without any help from the workman. Ordinary pins are made of wire, of the thickness required. Black pins are made by boiling brass pins in japan varnish instead of with tin.

Pine. [AS. *pin*, from L. *pinus*.] The name of a family of cone-bearing trees, found in Europe, Asia, and America, growing chiefly in mountainous or other exposed situations. Their leaves are needle-shaped, growing in clusters or in pairs, and surrounded with little scales at their base. The most important species is the American white pine, widely used in carpentry from the softness and ease of working of its timber. Other species are the red Canadian pine, the yellow pine, the nut pine, the sugar pine, and the pitch pine. Under this name are sometimes included spruces, firs, larches, and true cedars (*q. v.*).

Pine-apple. The fruit of a plant of the same name, a native of tropical America, now largely cultivated in most hot countries. The plant has many long, stiff, sharp-pointed leaves, from the middle of which grows a short stem bearing a single fruit, in shape like the cone of a *pine*. Pine-apples are sent from the West Indies and Azores to all parts of the world, and are much valued as a fruit for dessert and for preserving. A spirituous liquor called pine-apple rum is made from the juice of the pine-apple in some warm countries. The leaves of the plant contain fine fibres or threads, from which is made the beautiful pine-apple cloth. This is largely manufactured in the Philippine Islands.

Pink. [*Dianthus* = the flower of Jove, or God's own flower.] The garden pinks and carnations, so varied in form and coloring, are supposed to have descended from a single species, known in Europe as *clove pink*, a native of the southern Alps. There are now nearly 400 varieties. The roots are annual or perennial, the stems herbaceous and jointed, bearing a pair of opposite, linear, apparently veinless leaves at each joint. The flowers have peculiar grace and fragrance. The carnation and picotee are modifications of the clove pink.

Pin′nace. [Fr., from L. *pinus*, a pine tree.] A small ship, having sails and oars, used as a tender to a larger vessel, and chiefly employed to obtain intelligence and to land men; also a man-of-war's boat.

Pipe. [AS.] A tube made of various materials—as earthenware, wood, metal, leather, gutta-percha, etc.—for the conveyance of water, steam, gas, or other fluid; used for a great variety of purposes in the arts and in domestic economy. Tobacco-pipes, used in smoking tobacco, usually take the form of a bowl and connecting tube, and are made of baked clay, porcelain, stone, meerschaum, wood, and various metals. Meerschaum pipes are beautifully carved. Pipe-stems are made of cane, and of cherry, elder, jasmine, and other woods; mouth-pieces are usually of bone, amber, ivory, and sometimes of silver. (See *Meerschaum*.)

Pis′tol. [Fr., from Ital. *Pistola*, a town in Italy, now *Pistoja*.] A small fire-arm that can be held in one hand while being fired; said to have been first made at Pistoja. (See *Revolver*.)

Pis′ton. [Fr., from L. *pistus*, *pinsere*, to beat. Same root as *pestle*.] A solid piece of metal or other material, in the form of a short cylinder, attached to a rod called the *piston-rod*, which in its turn is attached to the adjoining machinery. It is made to fit exactly the cavity of a pump, tube, or other cylindrical space, in which it works up and down alternately, and is employed in forcing some gas or liquid into or out of the tube which it fills, as in steam-engines, fire-engines, and pumps (*q.v.*).

Pitch. [L. *pix*.] A thick, black, sticky substance got by boiling down tar, used for coating ropes, canvas, etc., and by ship-builders for filling up the seams and coating the outsides of ships and boats.

Plaice. (L. *Platessa*.) A common flat fish, somewhat like a flounder. The sides of the body are more compressed than in other fishes. It is caught in large quantities in European waters as a food fish.

Plane-tree. [Fr., from L. *platanus*.] A tall spreading tree, with broad leaves shaped like an open hand, and seeds united in little globular pendent balls. The best-known species are the Oriental or Asiatic plane-tree, and the Occidental or American, which is also called the buttonwood and sycamore. It grows almost all over the United States east of the Rocky Mountains. It is occasionally more than 100 feet high and from 12 to 15 feet thick, and makes an excellent shade tree. Its wood is hard and close-grained, and largely used for joiners' work.

Plant. [AS., from L. *planta*, a plant.] An organized living thing, generally without feeling or voluntary motion, with a root, stem, and leaves, though consisting sometimes only of a single leafy expansion. Plants grow in a great variety of forms, such as trees, shrubs, herbs, grasses, ferns, mosses, lichens, etc. Trees and shrubs are called perennials, because they live on through many years. Herbs are divided into annuals, biennials, and perennials. All parts of a plant—root, stem, leaves, flowers, and fruit—are made up of cells of different kinds, and by means of these the plant lives and grows. The food of plants is partly gaseous and partly liquid. The gaseous food is carbonic acid, which they get chiefly from the air, and take in principally by their leaves. The liquid food is water, which they take up mostly through their roots. Most plants grow from seeds, and although all do not bear true flowers and real seeds, they all have something which answers for seeds. Thus we have flowering plants and flowerless plants. The former class includes almost all trees, shrubs, and herbs; while ferns, mosses, sea-weeds, lichens, and fungi constitute the latter. Flowering plants are divided into two classes, which differ from each other in stems, leaves, and seeds. These classes are further divided into orders or families, each of which is named after some chief plant of its order—as the Oak family, the Pine family, the Rose family, etc.

Plan′tain. [Sp. *plantano*.] A plant or tree and its fruit, of the genus *Musa*, found in the countries of the torrid zone. The plantain attains a height of from 15 to 20 feet, with leaves often more than 6 feet long and nearly 2 feet broad. Its fruit is extensively used as food. (See *Banana*.)

Plas′ter. [L. *emplastrum*, with *em* dropped.] A mixture of lime, sand, and water, employed in overlaying the interior and exterior faces of walls. *Plaster of Paris*, sulphate of lime—a powder extensively employed in making casts of statuary.

Plate-glass. A fine kind of glass (*q. v.*), cast in plates, used for looking-glasses, etc.

Plat′inum. [Span., from *plata*, silver.] A comparatively rare metal, found only in the native state, commonly in grains, scales, or nuggets, and generally alloyed with five other metals—namely, palladium, rhodium, iridium, osmium, and ruthenium. It is obtained chiefly from the Ural Mountains, and in smaller quantities in Brazil, California, Ceylon, and Borneo. Platinum possesses a dull white color, and does not tarnish under any circumstances in the air. It is heavier than gold, as soft as copper, and may be hammered into thin plates and drawn out into fine wire. It is very infusible, and can only be melted by the heat of the oxy-hydrogen blowpipe. It is used for electrical and chemical apparatus, and since the introduction of platinotype processes in photography the metal has very much increased in price.

Plov′er. [Fr., the rain-bird; from L. *pluvia*, rain.] A genus of wading birds, which are found in every quarter of the globe. Many of them are birds of passage, and they are prized as game birds. Among the more important species are the black-breasted plover and the golden plover of Europe and America, the ringed plover, Wilson's plover, the stilt plover, and the lapwing. (See *Lapwing*.)

Plum. [AS., from L. *prunus*.] The name given to a tree or shrub and its fruit. It belongs to the genus *Prunus*, of which there are several species. From 200 to 300 varieties of plums are derived from the *Prunus domestica* species. Among the best known are the *green gage*, the *Orleans*, the *damson*, the *purple gage*, and the *German prune*. Plums are much used for dessert, and are made into preserves and prunes.

Plumb. [L. *plumbum*, lead.] A little weight of lead attached to a line, and used by builders, etc., to indicate a vertical direction. *Plumb-line*, the cord by which a plumb-bob is suspended.

Plumba′go. [L. *plumbum*, lead.] Native carbon in hexagonal crystals, of black color and metallic lustre, and so soft as to leave a trace on paper. It is used for pencils, for crucibles, and as a lubricator.

Plum′met. A piece of lead attached to a line, used in sounding the depth of water. *Plummet-line*, a line with a plummet.

Plush. [Fr., from L. *pilus*, hair.] A kind of cloth with a nap or shag on one side, longer and softer than the nap of velvet.

Poin′ter. A breed of hunting dogs which, when they scent game, stop and stand motionless until the hunter is near enough to shoot. Then, at the word, the dog darts forward and springs the game.

Poi′son. [Fr., from L. *potio*, a drink.] Any substance or matter which, when introduced into the body in any way, can destroy life by its own inherent qualities without acting mechanically. *Poison* usually denotes something received into the system by the mouth, breath, etc. *Venom* is something discharged from animals and received by means of a wound, as by the bite or sting of serpents, scorpions, etc.

Pole′cat. An animal of the Weasel tribe that is highly destructive to poultry. It possesses glands which secrete a fluid of a very offensive odor. This it gives off when pursued, thus checking dog or man until the animal can escape. It occurs in all parts of Europe. The weasels generally emit a fetid secretion, much the worst examples being those of the polecat and the frightfully offensive skunk (*q. v.*).

POTTERY

Polo. A game of ball resembling hockey, the players being on horseback. It is of Eastern origin, and the name properly signifies the ball used in the game.

Pomade′ or **Poma′tum.** [Fr., from L. *pomum*, an apple; pomade being formerly made by boiling apples in fat.] Ointment made of some fine inodorous fat, such as lard or suet, and used instead of liquid oil for dressing the hair. It is perfumed by the addition of fragrant essences or essential oils.

Pomegran′ate. [Fr., from L. *pomum;* and *granatus*, grained, having many grains or seeds.] A tropical shrub or small tree and its fruit, which is red, as large as an orange, and has a thick, leathery skin containing a juicy, pleasant-flavored pulp and numerous seeds. The pulp and the seeds are the parts eaten. The rind of the fruit and the bark of the root are used for tanning the finest morocco leather, and also in medicine.

Pop′lar. [Fr., from L. *populus*, a poplar.] A tall tree of the same family as the willow, of rapid growth, and having soft wood, capable of many uses. About twenty species are known, growing chiefly in mild and cold climates. The most important are the gray poplar, a native of Britain; the Lombardy poplar, of a conical form and without horizontal branches; the balsam poplar, the buds of which are covered with a sticky varnish called balsam; the Canadian poplar, and the cottonwood, a valuable timber tree, which is very abundant on the upper sections of the Mississippi and the Missouri valleys.

Pop′py. [AS. *popig.*] A herbaceous plant belonging to the genus *Papaver*, and bearing large, showy, but short-lived flowers. The most important species is that known as the opium or oil-poppy. It is extensively cultivated in warm climates for its milky juice, which when condensed forms the opium of commerce, and also for the bland fixed oil obtained from the seeds. *Poppy oil* is as sweet as olive oil, and is employed for culinary purposes. (See *Opium.*)

Por′celain. [Fr., from Ital. *porcellana*, the porcelain or Venus shell: L. *porcus*, a pig.] A fine kind of earthenware, first made in China and Japan; so called from its likeness in color to the Venus shell, which was thought to resemble in shape the back of a young pig. It is now made in Europe and America. It is also called *china* or *chinaware*. Some of the French and English porcelain, especially that made at Sèvres and Worcester, is extremely white and translucent, but is more apt to crack by sudden changes of temperature, and is more brittle, than the finest porcelains of China and Japan. (See *Pottery.*)

Por′cupine. [Fr., from L. *porcus*, a hog; and *spina*, a thorn.] A nocturnal rodent quadruped, about two feet long, having on the head and neck a crest of long hairs, very short hair on the legs and muzzle, and the other parts covered with spines or quills, some a foot long, which, when excited, the animal raises almost at right angles with the body. Porcupines generally inhabit warm or tropical regions. The common or crested of southern Europe and northern Africa, and the Canadian or North American, are the best known species.

Por′phyry. [Fr., from Gk. *porphyrites: porphyra*, purple.] A hard, finely-grained stone or rock, having a compact felspathic base, through which are scattered distinct crystals of one or more minerals. Porphyry may be green, with blotches of paler green or white; or red, with white blotches or specks; and has other shades of color. The blotches of a polished surface are the felspar crystals. The rock abounds in Egypt, in the northern parts of Europe, in South America, and in Mexico. All the varieties are esteemed as marbles, and used in fine sculpture-work.

THE POPPY PLANT.

Por′poise. [Fr., from L. *porcus*, a hog; and *piscis*, fish.] This animal belongs to the same genus as whales, and is the smallest and most familiar of the cetacean mammalia. It is from 4 to 6 feet in length, of a dusky or blackish color on the back, and white beneath. It is closely allied to the dolphins, but has a shorter snout. When swimming, its round back looks like a hog in water. Porpoises swim in shoals, and drive herrings, mackerel, and salmon before them. They seek for prey near the surface, but also descend to the bottom in search of sand-eels and sea-worms, which they root out of the sand with their noses, as hogs do in the field for their food. From their blubber or flesh a fine oil is made, and from their skins leather for the uppers of boots and shoes.

Pot′ash. [*Pot*, and *ashes*, prepared by evaporating in iron pots the lixivium of the ashes of wood.] An alkali much used in the arts. It is an oxide of potassium, though the potash of commerce, usually called crude potash, is properly potassium carbonate, because it contains carbon as well as potassium and oxygen.

Potas′sium. A metal of a bright silver-white color, derived in 1807 by Sir Humphrey Davy from potash. It is prepared by heating together potash and carbon to a high temperature in an iron retort. It is lighter than water, brittle at 32° Fahrenheit, malleable at a little higher temperature, melts at 62°, and when heated to a temperature below red heat it yields a fine green-colored vapor. It has a strong affinity for oxygen, taking fire when thrown upon water or ice, and oxidizes so readily that to be preserved it must be kept in substances which contain no oxygen, as naphtha or kerosene. Its compounds are very important, being used in glass and soap making, in artificial manures, and in many drugs and chemicals. The most important of the salts of potassium are potash, nitre or saltpetre, chlorate of potash, and cream of tartar.

Pota′to. [Span. *patata*, potato, from the native American word (probably *batata*) in Hayti.] Next to the cereals or grains, the potato is the most valuable of all plants used for food. It is a native of South America, and was introduced into Great Britain by Sir Walter Raleigh in the sixteenth century. The potato plant has a portion of its stem underground, and this part sends out roots and real branches. It is at the ends of these branches that potatoes are formed. Every part of the potato plant except the tuber dies off on the approach of winter, and the tuber is the special provision made by the plant for reproduction. The eyes of the potato are real buds, and the solid flesh of the tuber consists mainly of starch, the destined food of the young plant. Potatoes are largely cultivated in all mild climates. There are very many varieties, differing in time of ripening, form, size, color, and quality. New varieties are raised from the seed, but potatoes are grown by planting the tubers or cuttings of them, care being taken to have at least one eye in each piece. About three-fourths of the weight of a full-grown potato is water, and of the other fourth about one-sixth is gluten and five-sixths starch.

Pot′tery. [Fr. *poterie*.] The term applied to all objects made out of baked clay. The art of forming utensils of clay is of very ancient origin, extending back to the early days of mankind. Its rudimentary condition, that of merely molding soft clay into the desired form and drying it by the heat of the sun, was succeeded by baking it in a fire to make it harder and less brittle. Other substances were afterwards mixed with the clay so as to make finer and more delicate pottery. Gradually the potter enhanced the value of the art by forming graceful designs, and by painting and decorating them, until at the present day the art of the potter is one of the most important. Pottery may be divided as regards material and baking into three kinds—earthenware, stoneware, and porcelain or china. The term *pottery* is applied to all ware of the opaque kind, while *porcelain* applies to that which is translucent.

Prai′rie. [Fr., from Low L. *prataria*; L. *pratum*, a meadow.] A large level tract of country, bare of trees, covered with coarse grass, and generally of a fertile soil. This name is applied to the treeless plains of the Mississippi valley. Similar plains in the South are called Savannahs.

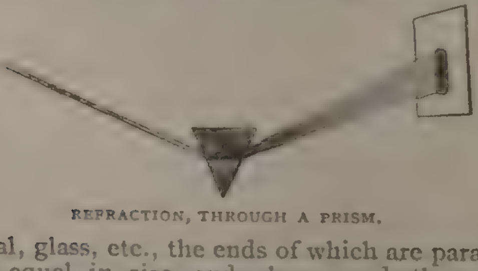
Prai′rie-dog. A small rodent animal, allied to the marmot, and found in the prairies west of the Mississippi. It is gregarious in habit, dwells in largely arid districts, makes deep burrows in the earth, and throws up mounds. On these the animal often sits, and, if disturbed, gives a warning cry somewhat like the bark of a small dog.

Precious stones. Minerals which are used in jewelry on account of their rarity and beauty. They include the diamond, ruby, emerald, sapphire, and many others.

Prim′rose. [Old Fr. *primerole*, from L. *primula;* corrupted in spelling as if from L. *prima rosa.*] A beautiful early-flowering plant, closely allied to the cowslip, common in meadows and on the banks of streams of England. The *evening primrose* is a biennial herb from 3 to 6 feet high, resplendent with yellow flowers which open at sundown, common in upland meadows, along fence-rows, and in sunny wastes.

Print′ing. The art of producing impressions on paper. It is divided into the printing of books and newspapers from movable type, and from stereotype or electrotype plates. Printing was known to the Chinese as early as the sixth century, but their system was that of printing from engraved blocks. The invention of movable types is claimed by the Dutch in favor of Coster, 1420; and by the Germans on behalf of Gutenberg, 1440. Printing was introduced into England by Caxton in 1477. Wooden types were first used, but those made of type metal are now general. The first apparatus used for taking the impressions from types and blocks was in the form of a screw-press. This rude contrivance was soon replaced by a wooden lever-press, which in turn gave way to the hand-press made of iron, and this to the steam-press. Books are printed either on single-cylinder machines, which print one side of a sheet of paper by passing it over a form of type or plates, or on double-cylinder or perfecting machines, which print both sides of the sheet while it passes through the machine. In both cases ink (*q. v.*) is supplied by a self-inking apparatus, consisting of slabs and several soft composition rollers. Newspapers and periodicals are printed on rotary or web-printing machines, which take an impression from curved stereotype plates fixed on a rotating cylinder, the paper being run into the machine from huge reels. These machines produce from 12,000 to 24,000 printed sheets per hour. The Walter press, the Victory, the Hoe, and the Marinoni are most in use, and usually have folding-machines attached, which deliver the sheets folded. For some periodicals, not only the body of the magazine but the cover is printed on the same machine, and the magazine folded and inserted inside the cover.

Prism. [Gk. *prisma*, something sawn off; *prizein* = *priein*, to saw.] A piece of wood, metal, glass, etc., the ends of which are parallel, and equal in size and shape, and the sides parallelograms. Prisms of different forms are often named from the figure of their bases, as triangular, hexagonal, etc.—In optics, a three-sided piece of glass with two equal and parallel triangular ends, used for separating the colors in a ray of light, and in refraction, etc. (See *Spectrum.*)



REFRACTION, THROUGH A PRISM.

Pri′vet. [From *primet*, perhaps from *prim*, because cut and trimmed.] An ornamental European shrub, much used in hedges. (*Ligustrum.*)

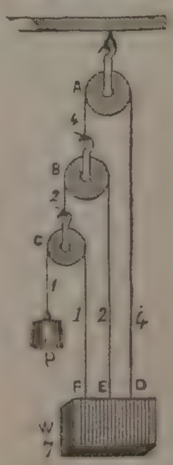
Propel′ler. A contrivance for propelling a steamship, usually consisting of a screw placed in the stern, and made to revolve under the water by an engine.

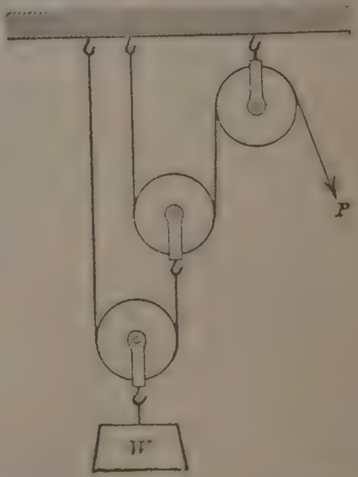
Prune. [Fr., from L. *prunum*, a plum.] A dried plum, much used in cookery. The best prunes come from France, where several kinds of plums are raised for making prunes. Great quantities are also exported from Bosnia and Servia.

Ptar′migan. The white grouse, a bird found in northern Europe and America. Its color in summer is a pale-brown or ash, with wings and under-plumage white. In winter its plumage changes in color to a pure white.

Puf′fin. An arctic sea-bird allied to the auks, so called from its short, thick, swollen beak and rounded belly. It is also known by the names of *bottle-nose*, *cockandy*, *coulterneb*, *mormon*, *pope*, and *sea-parrot.*

Pul′ley. [Fr., from *pull*, or from Low L. *pullanus*, a colt.] One of the mechanical powers, consisting of a wheel called the *sheave*, movable about an axis, and having a groove cut in its circumference, over which a cord or rope passes. The rope is attached at one end to a fixed point, and the force acting on the free end of the rope is doubled, but the load is only moved through half the space traversed by the rope. Pulleys are used either singly to change the direction of the power applied, or in various forms of combination to raise heavy weights.

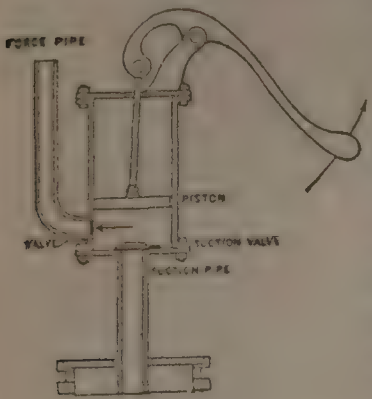




Puma. (See *Cougar.*)

Pum′ice. A porous mineral thrown out from volcanoes. It is a spongy lava, so light that it will float on water. It is powdered and used as a polishing material.

Pump. A hydraulic machine, variously constructed, for raising water and other liquids. The common or suction pump is constructed as follows:—The lower end of a long, narrow, vertical pipe, called the *suction-pipe*, is immersed in a



well or reservoir of water, and the upper end communicates with a wider pipe, called the *barrel*, which has a lid on the top and a spout on one side near the top. The barrel contains two valves, both opening upwards,—the lower one, between the suction-pipe and the barrel, called the *suction-valve;* and the upper one, called the *piston valve*, affixed to the upper surface of a movable piston, connected by a rod with the handle of the pump. On working the pump the air below the piston is exhausted, and water is forced into the vacuum and through the lower valve by atmospheric pressure. On the descent of the piston the water above the lower valve, closing that valve by its weight, passes through the piston, and is then lifted to the level of the discharging tube or spout. (See *Air-pump* and *Force-pump.*)

Pump′kin. The fruit of a plant allied to the squash, and belonging to the gourd family. The plant is a running vine, the fruit a large oblong globe, of orange color when ripe, and sometimes of immense size. It is used for feeding cattle, and as a food; either boiled, or made into a pie with other ingredients.

Purse. [Fr., from Low L. *bursa*, a purse: Gk. *byrsa*, a hide.] A small bag for money, generally made of skin or leather; a small bag or pouch, the opening of which is made to draw together closely.

Put′ty. [Fr., from *potee*, from *pot*, pot; what was formerly called *putty* being a substance resembling what is now called *putty powder*, and in part made of the metal of old pots.] A mixture of whiting or soft carbonate of lime and linseed oil, beaten to the consistence of dough, and used in fastening glass in sashes, and for filling up crevices, etc. *Putty powder* is an oxide of tin, or of tin and lead in various proportions, used in polishing glass, metals, and precious stones.

Pyr′amid. A solid body whose base is a square, triangle, or polygon, and its sides plane triangles, meeting at top in one common point. Architecturally, it applies to the great mounds of stone or brickwork found in Egypt, and in some other countries. The largest of the pyramids is that built by Cheops, on the plain of the Nile. This has a square base, each side of which measures 763 4 feet, while its height is 480 feet. The pyramids contain sepulchral chambers, in which the bodies of the Pharaohs were buried.

Pyrometer. [Gk. *pyr*, fire; and *metron*, a measure.] An instrument for measuring heat too high in temperature to be measured by common thermometers, as the heat of furnaces.

Pyx. [Gk. *pyxis*, a box; *pyzos*, box-wood.] The sacred box in the Roman Catholic Church in which the host is preserved; the box at the Mint which holds the sample coins that have been tested for the weight and fineness of the metal; the box in which the compass is suspended.

Q

Quad′rant. [L. *quadrans*, a fourth part.] An instrument used in astronomy, navigation, surveying, and gunnery, for measuring altitudes and determining angular measurements. It generally consists of a brass limb, the quarter of the circumference of a circle, mounted on a frame and marked with degrees, minutes, etc., and having a plumb-line or spirit-level for fixing the vertical or horizontal direction.

Quag′ga. An animal of the Horse tribe, found in southern Africa. It strongly resembles the zebra, though of smaller size. It is social in habit, lives in large troops, and is more easily tamed than the zebra. It is said to have been largely or wholly exterminated by hunters.

Quail. [Fr., from Low L. *quaquila;* from Old Du. root of *quack*, because of its cry.] A bird of passage, the smallest of the Partridge family, common in the south of Europe, and in Asia, Africa and North America. Quails live in flocks, feed chiefly on insects, slugs, grains, and seeds, and are noted for taking long and fatiguing journeys. Immense flocks visit the countries along the Mediterranean, and large numbers are caught for food. The flesh is more juicy and delicate than that of the partridge.

Quar′rantine. [Fr. *quarante*, forty; L. *quadraginta.*] The space of time, formerly forty days, but now variable in length, during which a ship suspected of having infectious disease on board is obliged to forbear all intercourse with the shore.

Quart. [L. *quartus*, fourth.] A measure of capacity, in dry and in liquid measure, equal to two pints, or the fourth part of a gallon. The English quart contains 69.32 cubic inches; the United States dry quart contains 67.20 cubic inches, the fluid quart 57.75.

Quartz [Ger. *quarz.*] The common name of silicon oxide or silica, the most abundant of all minerals, being one of the constituents of granite, gneiss, mica slate, etc. It forms quartz rock and sandstone, and makes most of the sand of the seashore. It occurs massive, crystallized, granular, and in other forms. The primary form of the crystal is a rhomboid; but it is generally met with in hexagonal prisms, terminated by hexagonal pyramids. When crystallized and pure, it is called *rock-crystal*, and is transparent and colorless. Quartz is so hard that it will scratch glass and strike fire against steel. It comprises numerous varieties, many of which are colored by different substances—as purple quartz, or amethyst. rose quartz, yellow quartz, chalcedony, agate, carnelian, bloodstone, jaspar, sard, onyx, cat's-eye, etc. Quartz is used in the manufacture of glass, and of porcelain and other kinds of pottery; also as a flux in the smelting of several kinds of ores. Gold often occurs in quartz veins, and quartz-crushing machines are used to extract the gold ore.

THE QUAIL.

Quas'sia. [Named from a negro, *Quassy*, who first made known the medicinal virtues of one of the species.] A genus of tree belonging to the tropical parts of South America. The wood of the root is intensely bitter, and is used in medicine, and sometimes as a substitute for hops in making beer.

Quay. [Fr. *quai.*] A bank or wharf constructed toward the sea or at the side of a harbor, river, or other navigable water, for convenience in loading and unloading vessels.

Quick'lime. A white, caustic, infusible powder, obtained in a state of purity by heating pure carbonate of lime to full redness; so called because when wet it develops great heat. The quicklime of commerce is obtained by calcining in kilns any carbonate of lime, as limestone, marble, chalk, etc. Mixed with sand and water it forms lime. (See *Lime.*)

Quick'silver. [*Quick* and *silver.*] Mercury; so named for the great mobility of its globules, and its resemblance in color to silver. (See *Mercury.*)

Quilt. [L. *culcita*, a bed, a cushion.] A cover or coverlet made by stitching one cloth over another, with some soft substance, such as wool, cotton, etc., between them.

Quince. [Fr. *coing*, from L. *cydonius*, a quince tree; so called from the town of Cydonia, in Crete, which was noted for its quinces.] The fruit of a shrub which grows in mild climates, and belongs to the same family as the apple. The fruit is usually pear-shaped, but some quinces look more like an apple. Quinces possess a hard flesh of high flavor, but very acid, and though not good to eat raw, they are largely used for marmalade, jelly, and preserves.

Quin'ine. [Fr.] An alkaloid obtained from the bark of different species of cinchona trees, originally known in Peru, but now transplanted to Java and India. It has a bitter taste, and forms the base of certain salts used in medicine. —*Sulphate of Quinine*, a salt crystallizing in snow-white, light, efflorescent needles. It is not very soluble in water, but dissolves easily when a drop or two of sulphuric acid is added, and is extensively used in medicine as a tonic and febrifuge.

Quire. [Fr. *cahier*, a book of loose sheets.] Twenty-four sheets of paper of the same size and quality, unfolded or having a single fold; one-twentieth part of a ream.

R

Rab'bit. A small rodent quadruped of the Hare family, living chiefly in large colonies called warrens, in burrows dug deep into the ground. They are not much seen during the day, but come out at night to eat, and they often do great damage by gnawing the bark off young trees and by spoiling growing crops. Rabbits are remarkably prolific, and have become pests in some parts of Australia and New Zealand. The common European species, which is often kept as a pet, has been introduced into many countries.

Raccoon'. [Fr. *raton*, a little rat.] A carnivorous animal of the Bear family inhabiting North America. Its body is gray, varied with black and white. The average length of the raccoon is about two feet from the nose to the tail, and the tail is about ten inches long. The head somewhat resembles that of the fox. It feeds chiefly by night, keeping in its hole during the day, except in dull weather. One of the marked peculiarities of the common species, *Procyon lotor*, and on which its specific name (*lotor*, from L. *lavare*, to wash) is founded, is its habit of plunging its dry food into water before eating it. Its fur is valuable, particularly in the manufacture of hats.

Rad'ish. [Fr., from L. *radix*, a root.] A garden plant, cultivated for its pungent fleshy root, which is eaten raw for salad.

Raft. [Scand.] A float consisting of logs, boards, or other pieces of timber fastened together, either to serve as a support in conveying other things, or for their own collective conveyance on the water.

Rail. [Fr. *raler*, to rattle in the throat.] Numerous species of birds prized as game birds. The common European *land-rail* is usually known as the corncrake. It has a grating cry, familiar in summer. The *water-rail* has a longer bill and darker plumage, and loves the wet marshes. It is found in Iceland, North Africa, and China. American species are the clapper-rail or marsh-hen, the king or red-breasted rail, the Virginia rail, and the Carolina rail or ortolan. The flesh of all these birds is delicate, and the Virginia rail is a favorite game bird.

Rail′way or **Rail′road.** A road or way of parallel iron or steel rails on which the wheels of carriages run, and supported on a bed or structure. *Railway* is the usual word in England, but *railroad* is common in the United States. The modern railroad is an adaptation of the old horse tram-roads, with cast-iron flange rails, used for hauling coals early in the century. The Stockton and Darlington Railway, the first line with locomotives, was opened in October, 1825. The first passenger line in the United States was the Baltimore and Ohio, opened in 1830. There are now over 190,000 miles of railroad in the United States, 160,000 in Europe, and about 450,000 in the world. Rails are now usually laid to the standard width or gauge of 4 feet 8½ inches. The iron rail, formerly wholly in use, has been widely replaced by steel. The steam locomotive known as the *Rocket*, invented by Robert Stephenson in 1829, weighed 8 or 9 tons; locomotive engines now weigh from 35 to 50 tons, and draw a train averaging from 400 to 500 tons. In 1838, on the London and Birmingham line, a speed of 20 miles an hour was obtained. Now a speed of 50 miles an hour, including stoppages, is maintained on one of the New York Central trains between New York and Chicago for a distance of nearly 1,000 miles, and 60 miles an hour is made on some roads for shorter distances. A straight and horizontal surface being the standard of perfection for railroad-making, sharp curves and steep gradients are regarded as evils. Routes are therefore shortened by embankments, cuttings, tunnels, and bridges. Among the remarkable railway tunnels are the St. Gothard and Mont Cenis in Switzerland, and the Hoosac Tunnel in Massachusetts. Of railway bridges the most wonderful are the Forth Bridge, Victoria Bridge (Montreal), Britannia (Menai Strait); also those at St. Louis, Rock Island, Louisville, and Niagara. Cars such as Pullman cars, with entrance at each end, are common in the United States and Switzerland; those entering at the sides are usual in Britain and other parts of Europe.

Rain. [AS. *regen.*] Water falling from the clouds in drops. This is the chief source of water-supply. By the heat of the sun water is evaporated from the surfaces of the seas and oceans and transported as water-vapor by winds. When it is condensed by cold, chiefly caused by the heated air rising into higher regions, it returns again to the liquid state, and falls down as drops of water in rain; or, if the cold be very great, the water may pass at once into the solid state, and fall as snow or as hail. *Rain-water* is very soft, and in country places it is pure; the air of large towns being full of impurities, the rain brings them down with it as it falls, and so purifies the air by washing it. In Britain the prevailing winds are westerly, and, being charged with moisture from the Atlantic, much rain falls on the western coasts, and pasture is abundant. In the eastern part of the United States, where there are no great mountains to catch the moisture, the rainfall is uniform; but in the west and north the rainfall is determined by a centre of low atmospheric pressure in the Rocky Mountains. The heaviest rains occur in the tropics, and are confined to one part of the year called the *rainy season.* At a point 100 miles north of Calcutta the annual rainfall is from 500 to 600 inches. In Burmah the rainfall is 200 inches.

Rain′bow. [AS.] A bow or arch in the sky opposite to the sun in time of rain, caused by the rays of light breaking up into their seven separate colors as they fall on the rain-drops. (See *Prism*, *Spectrum*, *Light.*) Rainbows sometimes occur on the spray rising from waterfalls. Most rainbows are seen in the afternoon, when the sun is in the west, and sometimes in the morning, but never at noon, because then the sun is above us, and we cannot stand between it and the rain. When there is a double rainbow the inner is the primary, and the outer the faint or secondary one.

Rai′sin. [Fr., from L. *racemus.*] A ripe grape dried in the sun or by artificial heat. (See *Grape.*) Raisins are dried either with the stalk cut nearly into two and left to dry on the vines, or with the branch wholly cut off, hung up, or laid on floors to dry. The first are best, and are called the muscatels or raisins of the sun, and the finest come from Malaga and Valencia in Spain. Sultanas are made from a grape without seeds, and are brought from Smyrna.

Ram′ie. The fibres from the bark of the ramie plant, a native of India, now grown in the United States. The fibre is strong and lustrous, but the difficulty of separating it from the bark has proved a check to its use. The plant is a tall herb, sending up long shoots after each cutting.

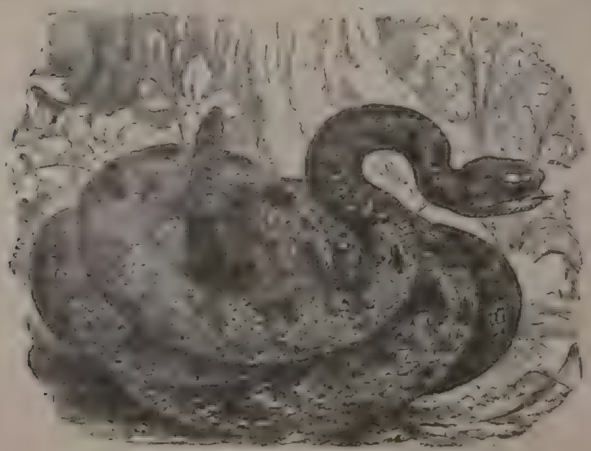
Rape. [L. *rapa.*] A root plant with a leaf like that of a swede turnip and a stem resembling that of a cabbage. It is sown in rows and hoed out like turnips. The plant grows rapidly, and its roots penetrate deeply into peaty soils and clays. The seeds are useful for cage-birds, and from rape-seed rape-oil is produced.

Rasp′berry. A kind of shrub with a thimble-shaped fruit, dark-red, large grained, and covered with a thick bloom. Like the strawberry it belongs to the Rose family; but, unlike the blackberry of the same family, the rasp separates readily from the core or receptacle. It has a perennial root, producing biennial woody stems or canes reaching to from 3 to 6 feet in height. Usually the canes do not bear till the second year, and that ends their life, their place being taken by a new growth from the root. The wild raspberry is called the bramble. Raspberries are used for jams, jellies and wine beverages.

Rat. [AS. *ræt.*] A gnawing or rodent animal like the mouse, but larger and more destructive. It has sharp chisel-shaped teeth, with which it gnaws holes through wood-work, and with its claws it burrows under floors. It can climb trees, and descend headforemost by means of its claws, which are hooked, and turn inward or outward. Rats are not easily caught, because they are so cunning and have so keen a scent that they will not go near a trap set by a person with bare hands. They eat both animal and vegetable food, and are found in fields, in woods, in the water, in houses, in barns, and in sewers. They cross the sea in ships, and have followed man over the world. They are a pest to the farmer, and destroy grain, steal eggs, and kill young poultry of the farm-yard. The rat increases in swarms, often alarmingly. But the cat, the dog, the ferret, the weasel, the hawk, and the owl all prey upon rats and keep down their numbers. They are fierce and dangerous and bite viciously. The common brown rat, or Norway rat, is about 10 inches long, and has a tail of about 8 inches, a pointed nose, and whiskers like a cat. Its fur is light brown above and dirty white beneath, and its feet are flesh-colored. The black rat is smaller and weaker. Water-rats are almost as large as brown rats, but are harmless, feeding on vegetable food, and making their holes in the banks of rivers, ditches, and ponds. Gloves are often made of rat-skin, and the fur is used for covering hats. In China the flesh of the rat is regarded as a delicacy. The squirrel-tailed wood-rat of the Rocky Mountains builds a great nest of sticks and brush in a tree or clump of shrubs.

Rat′chet-wheel. A toothed circular wheel acted on by a bar or catch. The wheel moves forward by a reciprocating lever, and cannot be reversed until a ratchet or click for preventing backward motion is removed or lifted.

Rattan′. The long, slender stem of a species of *calamus* and other allied species of palms, which are among the most useful plants of Malaysia. These stems are largely used for cane-work, and also for making walking-sticks.



RATTLESNAKE.

Rat′tlesnake. [O.E.] A poisonous snake of America, with horny interlocking joints at the end of its tail with which it makes a rattling sound before striking its prey. The rattle is composed of a number of horny, button-like rings which fit loosely into one another and make a rustling noise when shaken rapidly. Some think that one new rattle is added with each shedding of its skin. The poisonous fangs take the place of other teeth in the upper jaw. These fangs are a pair of large teeth punctured by a tube from the poison-gland. They are laid back when not in use, but when the snake strikes its prey the fangs spring forward and the poison flows from the poison-gland. Its bite is very poisonous, and it is very much dreaded. The best known are the diamond rattlesnake of South America and the common rattlesnake of North America. (See *Fang.*)

Ra′ven. [AS. *hræfen.*] (*Corvus corax.*) A bird like the crow, but larger, with a croaking voice and thievish habits as regards trinkets and food. It was once plentiful in England, but is now rare. Its color, though apparently black, is a deep blue. Its wings are long and slightly rounded, and its flight steady and rapid. It has a sedate walk, and when carrying off food has a curious hop, and makes use of its wings at the same time. It is wary, but is easily tamed and very sagacious. The raven is found in most parts of the globe, and ranges as far north as Melville Island, it being one of the few birds that brave the cold of an Arctic winter.

Ray. [Fr.] A flat kind of fish with ray-like fins on its breast. It has eyes on the upper surface, which is the back of the animal, and not the side, as in ordinary flat-fishes. The mouth is large, and the jaws are covered with numerous rows of small pointed teeth. The skin is usually beset with spines, in many cases resembling true teeth in structure, and sometimes quite formidable weapons. Its eggs are enclosed in brown leathery four-sided cases like those of the shark or dog-fish, and with long processes at the angles. True rays have the snout more or less pointed, the tail slender, and two small dorsal fins. The Ray family includes the skate and thornback. Sting rays have long, tooth-like spines, which are often used by savages to form barbed spear and arrow heads. The sting ray is common in the Mediterranean. Eagle rays, or white rays, have great pectoral fins, which resemble wings, and their tails are like whips. Sharp-nosed rays are favorites of the French, who eat them instead of skate. Electric rays are sometimes called torpedo fishes.

Ra′zor-bill or **Common Auk.** A sea-bird allied to the great auk, which is now extinct. It has wings large in proportion to its size. It is 17 or 18 inches long, and its wing is 7 or 8 inches, and when extended the wings are 27 inches wide. It has a glossy black head, a dark-brown throat, a white breast, and lower body of white. Its bill is strong and hooked. It lays one large egg of a greenish color. This bird abounds in the Arctic seas, migrating southward in the cold season.

Ra′zor-fish. A long, slender, and brittle mollusc that abounds on all sandy shores. The shell has delicate tints of rose and violet, covered by a brown epidermis. By means of its muscular foot it digs a deep hole, which it does not leave, but raises itself to the entrance of the hole. It is timid and difficult to catch.

Ream. [Fr., from Arab, *rizmat*, bundle.] A quantity of paper, consisting of 20 quires or 480 sheets. A common practice now is to count 500 sheets to the ream.

Reau′mur. A thermometer with zero as the melting-point of ice, and 80° the boiling-point of water. Four degrees of Reaumur are equal to 5 degrees Centigrade and 9 degrees Fahrenheit. The Reaumur thermometer is in general use in Spain and Germany.

Reed. [AS.] A thick, coarse grass, with hollow, jointed stalks, growing in or near water. The *common reed* grows in Europe and North America. The bamboo is a useful reed. The papyrus is often called the *Egyptian reed.*—A slip of cane in the mouth-piece of a musical instrument, and set in vibration by the breath. In the harmonium, melodeon, and accordeon the reed is a thin piece of metal which by vibration produces the tones of the instrument.

Reef. [Du. *rif*, a rift.] A line of rocks lying at or near the surface of the water. Any large vein of auriferous quartz or rock yielding ore is called a reef.

Reflec′tion. The effect produced upon light by a smooth surface. Part of the light enters the body, part is thrown back or reflected at an angle opposite to that made by the incident ray. This is the principle of the mirror, the body whose light is reflected seeming to lie behind the mirror, in the direction of the reflected ray.

Refrac′tion. When a ray of light passes from space through the air, or from air through water, glass, or other transparent, it is bent from its original course more towards the line leading to the earth's centre. This bending is known as refraction, and is the source of various important phenomena of optics.

Rein′deer. [Scand. from Lappish.] A kind of deer with branching horns found in the extreme north parts of Europe and America. Reindeer are gregarious and herd together. The full-grown bucks shed their horns. The horns of the female reindeer are retained during the winter. The reindeer feeds on the lichen that thickly carpets barren lands in the subarctic regions. The common European reindeer is domesticated in Lapland. Laplanders depend on it for its milk, and as a beast of burden, or to draw sledges over the snow. When the path is good and not too hilly, the reindeer can travel 100 miles a day. Their feet are well suited for walking on snow, owing to the manner in which the hoofs separate in treading, and to the long, coarse hair growing between the hoofs. The Siberian reindeer is larger than that of Lapland. The reindeer of North America are the cariboo or woodland reindeer, found in Canada and Maine, and the barren ground reindeer of the Rockies.

Rem′ora. A fish possessed of a structure which enables it to cling to foreign bodies. This is a modification of the dorsal fin, which becomes a flattened disk covering the top of the head, and acts as a sucker. Fables have arisen to the effect that this fish could arrest the course of a ship to which it attached itself. The species are from 12 to 20 inches long.

Rennet. [AS.] A preparation of the inner lining of the fourth stomach of a calf, used to curdle milk.

Reptile. [Fr., from L. *repere*, to creep.] Reptiles form the first class of the higher vertebrata, or of those which never breathe by gills, like the amphibians. Their blood is cold, and they closely resemble birds in the development of their young; but their eggs are very large. Reptiles include alligators, turtles, snakes, and lizards. Formerly amphibians were classed with reptiles, and are still properly called reptiles, though more closely allied to the fishes. Reptiles, except tortoises, are long, often nearly cylindrical, and usually covered with scales, and have long tails. The feet are of different lengths, but seldom suffice to support the body, the belly trailing on the ground when the animal is in motion. The mouth is large and armed with sharp, hooked teeth; but in tortoises no teeth exist. The heart generally has two auricles and one ventricle. The ribs are always well developed; the limbs when present are well developed; the feet are freely movable, and end in strong claws. Except tortoises, all reptiles are carnivorous, feeding upon living prey; their teeth not being constructed for the division of flesh, they swallow their victims whole. Reptiles are essentially inhabitants of the warmer regions of the earth. In earlier geological periods, before the age of the mammalia, reptiles were often quadrupeds of immense size and strength. Some were essentially tripeds, supporting themselves on their hind legs and tails; and some gained the habit of flying, with the aid of membraneous wings.

Res′in. [Fr., from L. *resina*.] A half liquid substance, that flows from trees. Resins are made up of carbon, hydrogen, and oxygen, and are probably the essential oils of the plants oxidized by the oxygen of the air. They dissolve in alcohol and ether and volatile oils, but not in water, like gums. Copal, lac, mastic, and benzoin are hard resins; turpentine and copaiba are soft resins. The common resin of commerce exudes from the pine tree, and is largely used in making varnishes and in several medicines.

Ret′ina. [L. *rete*, a net.] A fine net-like coating at the back of the eye, made up of the optic nerves which carry the sense of sight to the brain. The optic nerve and retinal blood-vessels spread out on the front of the retina, and the sensory layer, with rods and cones, is on the back part next the choroid coat.

Retort′. [L. *retortus*, twisted back.] A vessel with a long bent tube used by chemists in decomposing substances or in distilling. For distilling liquids a glass retort is employed. Metal retorts are used in distilling coal, wood, or bones.

Retriev′er. [Fr.] A dog trained to find and bring back game that has been shot or wounded.

Revolv′er. A pistol with several chambers revolving on an axis, that can be fired one after another by the same trigger through the same barrel.

Rhe′a. The American ostrich. This is scarcely more than half the size of the African species, and differs from it in having the head feathered. It is gray in color, and has none of the beauty of the true ostrich. It is abundant in South America.

Rhe′ostat. A resistance box in the path of an electric current, for the purpose of increasing the general resistance to the current flow. The box contains coils of wire made of a metal that is a poor conductor of electricity. When the current is first turned on to a motor, as that of a streetcar, it is important that it should be done gradually, so that the motor will not start off at once with full force. This is accomplished by sending the current through a rheostat. If the box have 12 coils, the current is sent at first through the whole of them, then, by turning the handle, through 11, 10, 9, and so downward, until all the coils are cut out and the entire strength of the current reaches the motor, and sets it turning at full speed.

Rhinoc′eros. [Gk. *rhis*, *rhinos*, the nose; and *keras*, a horn.] A hoofed animal with a horn, and next in size to the elephant. Its horn is placed upon the skin behind the nostrils. It is not unlike whalebone, and is made of a number of fine hairs firmly glued and pressed together. The point of the tip is very smooth and quite sharp, but the lower part where it joins the skin is rough. It is very heavy, and is made into drinking-cups. The Indian or white rhinoceros and the Javan rhinoceros have one horn. Two or three African kinds have two horns, but no canine or incisor teeth. The lower horn stands straight out from the head, and is often 4 feet long. The rhinoceros is from 4 to 5 feet in height and 11 in length, and has such a thick, tough skin that nothing can pierce it, therefore the natives make it into shields. The rhinoceros has a savage temper, and is a dangerous enemy. It lives alone in thick forests by the banks of rivers; for it is a great swimmer, and spends a great portion of its time in water, where it can easily find leaves and grasses for food. It has on each foot three toes, with a hoof on each toe.

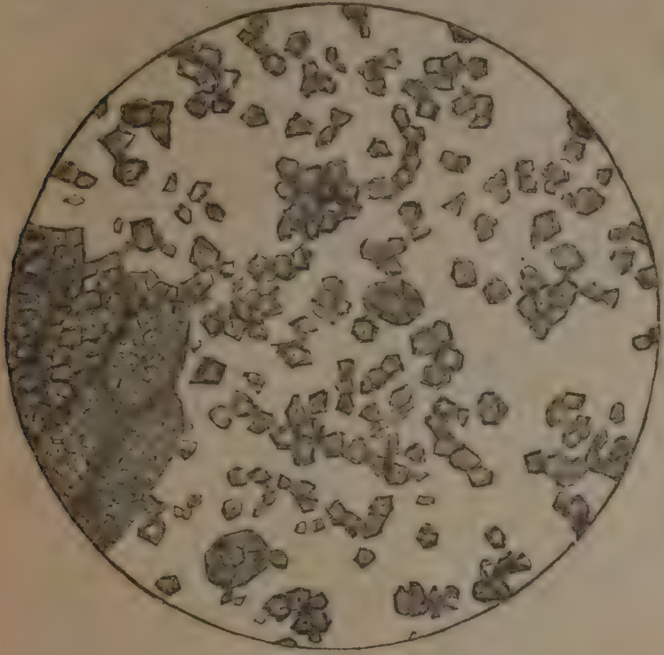
Rhododen′dron. [Gk. *rhodon*, a rose; and *dendron*, a tree.] A kind of shrub of the Heath family, with evergreen leaves and large, showy flowers like roses. No other shrub equals it for beauty of form and foliage and profusion and variety of flowers. It is abundant in the mountain regions of the eastern United States, often forming impenetrable thickets in the northern Alleghanies. It is also common in India. Several species have been domesticated and a great variety of very handsome flowers produced by cultivation.

Rhu′barb. [L. *Rha*, Volga; *barbarus*, foreign.] A plant (*Rheum rhaponticum*) brought from the banks of the Volga, the stalks of which are used as food. The stalk is large and fleshy, and very juicy; the blade is broad, with large veins running from the foot-stalk. The stalk and veins are smooth, and covered with a fine thin skin easily removable when the leaf is young. It is used as a substitute for fruit in pies and tarts, and the juice is pressed into wine. Rhubard of medicine is the dried root of a wild plant (*Rheum officinale*) now chiefly brought from China and Tibet.

Rib′bon or **Rib′and.** [Celt.] A long, narrow web of silk or other material used for trimming dresses. Ribbons are chiefly made at St. Etienne in France, Basle in Switzerland, Coventry in England, Crefeld in Prussia, and Paterson, New Jersey. French and Swiss ribbons are handmade; English ribbons are machine-made. Italian and French silk is used in making the best ribbons.—*Ribbonfish* is a fish of the North Atlantic, 20 feet long.

THE AGE OF REPTILES.

Rice. [Fr., from Gk. *oryza*.] A grain grown in warm countries, and forming a food for three-fourths of the human race. Rice is a kind of grass, having a stalk with several stems, each of which bears a cluster of grain. It requires a hot climate and abundance of water. The plant is a native of the East Indies, and is most largely grown for food in India and China, but it is grown also in the southern United States and in the south of Europe. Its habits of growth have been modified by cultivation, so that a variety is grown on uplands without irrigation. The lowland crops are grown with irrigation on lands where no other crop is possible. Rice flour is used for cakes, and rice water is used medicinally. Rice forms the chief food of the Chinese and the Hindus. It contains in 100 lbs. no less than 76 lbs. of starch, which is largely used in the laundry to stiffen linen, etc.



RICE STARCH UNDER MICROSCOPE.

Ri'fle. [Dan., to make grooves in.] A gun, or small-arm, the inside of whose barrel is *rifled*, that is, has spiral grooves cut in it. The effect of the grooves is to send the balls swifter and straighter. The rifles now used are breech-loaders. Cannon are also rifled, with the effect of enormously increasing their range and powers of destruction.

Rin'derpest. A malignant contagious fever, which attacks cattle and other ruminants. It came originally from Asia, and has very often appeared in Russia, from which it made its way over Europe, probably as early as the 4th century. There have been various outbreaks of it, causing great destruction of cattle. From 1865 to 1870 it caused great mortality, 130,000 cattle dying in France alone in 1870. In 1896 a serious epidemic broke out in Africa, extending from Abyssinia to South Africa, and decimating the domestic herds, while destroying great numbers of wild animals, especially antelopes. No cure is known for this disease, and the only safety is to kill and bury all infected animals.

Riv'et. [Fr., from Scand., to fasten.] A pin or bolt of metal passed through two flat pieces of metal, wood, etc., and fastening them together by its being hammered flat at both ends.—*Butt riveting.* The ends or edges of plates form a butt joint, and are fastened together by being riveted to a narrow strip which covers the joint. *Lap-riveting.* The ends or edges of plates overlap, and are riveted together.—*Chain-riveting.* The rivets in two or more rows are set behind each other.

Roach. [AS.] A European fresh-water fish of the Carp family, to which the dace and chub belong, of silver-white color, with a greenish back. The scales of this fish and the bleak are said to be employed in the manufacture of artificial pearls. Gold-fish belong to a similar family.

Rob'in. [From *Robert.*] A name given to red-breasted birds of different countries belonging to the thrush family. The robin of the United States is a common and favorite bird, its song being among the sweetest of those heard in our groves and orchards. The robin-redbreast of Europe is a smaller bird, which seems to delight in the presence of man, often entering his dwelling. It sometimes takes up its abode in houses in cold weather, while it warbles its song when the sun shines or the fire burns brightly.

Rock'et. [Ital., from *rock*, a distaff.] A fire-work sent up through the air and used as a signal. The rocket is projected by the force of expanded gases liberated by the combustion of such ingredients as nitre, charcoal, and sulphur. Congreve rocket, invented by Sir William Congreve, is armed with shells or case-shot, or with a fiery composition.

Rock-oil. (See *Petroleum.*)

Roco'co. A florid style of ornamentation which was common in Europe in the latter part of the eighteenth century.

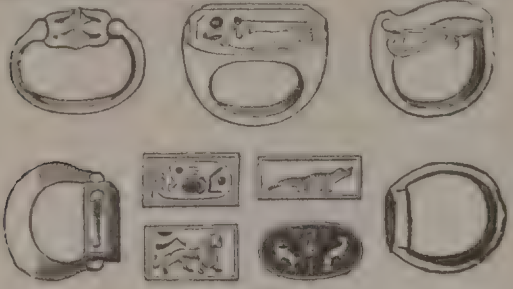
Ro'dent. [L. *rodens*, gnawing.] A gnawing mammal, as a mouse or rat. They are all small, but very prolific, so that no mammalia are so generally distributed. Their teeth are peculiar and of two kinds—incisors and molars. The enamel remaining, while the body of the tooth wears away, gives it a peculiar curved shape.

Roe. [Scand.] The spawn or eggs of fishes and amphibians, especially when enclosed in a membrane.

Roe. [AS.] The smallest kind of European deer. Its antlers are small, with three short branches. It remains faithful to one partner for life.

Roent'gen Ray. On December 4, 1895, Professor Roentgen, of Würzburg, Prussia, published a description of a remarkable new ray of light he had discovered, which he called the "X-ray." This light flows from a Crookes tube, which is a glass tube exhausted of air, and traversed by an electric current. From the interior glow in this tube there flows a ray differing from ordinary light, since it fails to pass through some transparent substances and readily penetrates many opaque substances. It passes easily through human flesh, and less easily through bone, so that the bones of the body may be photographed as dark shadows. An important fact is that any foreign substance in the body, as a bullet, a needle, etc., is revealed by the ray, and its exact location fixed. This renders the Roentgen Ray of the greatest value in many surgical operations.

Rook. [AS.] A bird like the crow, but smaller, with the base of its beak bare of feathers and quite white, and with a harsh, croaking voice. It feeds on grubs and worms, but will pull up new grass and potatoes, pick turnips, and steal eggs. Rooks are sociable birds, and build their nests together and live as one family. They usually settle in a clump of high trees, which is called a *rookery*.



SIGNET RINGS.

Ro'sary. A series of prayers marked by beads, consisting of fifteen decades, each containing ten *avemarias*, a *paternoster*, and a *gloria patri*.

Rose. [L. *rosa*.] A shrub, usually with prickly stems, and large, beautiful, and sweetly-smelling flowers. The varieties of roses are generally classed as damasks, banksia, noisette, perpetuals, French, Chinese, Scotch, celestial, and moss roses. All may be propagated by layers, some by budding or grafting, and many by separating the roots. The moss rose came from Holland, the cabbage rose from Caucasus, and the yellow rose from Persia. In France the cultivation of the rose is a science. The varieties are great; of the tea rose alone there are 122 kinds. The Cherokee rose is a native of China, which has run wild in the American States. The sweet brier has also escaped from cultivation, and is found in the hedgerows. The oldest rose-bush in the world is at Heldersheim, in Germany. The trunk is as large as a man's body; and in the year 1079 a framework was put up to support its branches. It is supposed to be over 1,000 years old.—*Otto of roses* is an oil distilled from petals or leaves of damask or musk roses. The best otto of roses is made from Cashmere roses in India.

Rose'mary. [L. *ros*, dew; and *marinus*, belonging to the sea.] A small shrub, with narrow grayish leaves, a fragrant smell, and bitter taste. It is an emblem of constancy. This shrub grows wild along the Mediterranean coast, and is found in Asia Minor and in China. An essential oil distilled from it is used in perfumery and medicine.

Rose'wood. A leguminous wood of a dark-red color streaked with black, with a faint smell like that of the rose. The finest rosewood comes from South America, especially from Brazil, but also from Jamaica, New South Wales, and the East Indies. The best is costly, and is chiefly used as veneering for cabinet-work.

Ros'in. The hard amber-colored resin left after distilling the volatile oil of turpentine.

Ros'trum. [L. *rostrum*, a beak.] The platform in the Roman Forum from which orators spoke to the people; so called because it was near where the beaks of ships taken in war were fixed. Also now any platform for speaking from.

Row'an Tree. [Scand.] The mountain ash, related to the apple, with pinnate leaves and small white flowers, followed by little bright-red berries.

Rub'ble. [Old Fr.] Rough stones from the quarry, or stones broken or worn with water, used for coarse building.

Ru'bric. [L. *rubric*, red chalk.] A part written or printed in red to distinguish it from the rest on a page.

Ru'by. [Fr., from L. *rubeus*, red.] A precious stone of a blood-red color, ranking in hardness next to the diamond. It is a red crystallized variety of corundum. The finest are Oriental rubies brought from Burmah, and are more valuable than diamonds of the same size. They occur in crystalline limestone, and consist of pure alumina, with the color of pigeons' blood. The spinal ruby consists of alumina and magnesia, and is found in Ceylon and Siam, varying from deep red to rose red in color.

Rum. A kind of spirit made from the juice of the sugar-cane or molasses. It is largely made in the West Indies and New England. Jamaica rum is colored reddish brown with caramel. Rum is sometimes flavored with pine-apple.

Ru'minant. [L. *ruminatus*.] An animal that chews the cud. (See *Digestion*.) Ruminant animals include the camel, deer, antelope, goat, sheep, and cattle.

Rupee'. [Sans., silver.] An Indian silver coin worth 16 annas, the value of which varies with the price of silver.

Rush. [AS.] A plant of many varieties, with a round pointed stem and no leaves, which grows in moist ground. Before carpets came into use, the floors of houses were strewn with rushes, and the wicks of candles were made from the pith of rushes. Chair-bottoms and baskets are sometimes woven of them.

SANDALS.

Rust. [AS.] *Blight*, *mildew*, and *rust* are names given to diseases which attack the stems and leaves of cereals and other plants. They first appear as small discolored patches, and gradually spread over the entire plant. This discoloration is due to the presence of germs or seeds of the rust fungus in the first stage of life. These germs or seeds, after several stages have been passed, settle upon the plants and live on their juices, thus doing much injury.—*Rust* is also the reddish-brown coating formed by oxidation on the surface of iron when exposed to a moist atmosphere.

Rye. [AS.] A kind of grain, and the hardiest of the cereals cultivated in the British Isles. It looks like wheat, but its ears are bearded like those of barley, but not quite so long. The grain is brown, and coarser than wheat. It will grow on poor sandy soils, and is able to bear a severe climate. Rye is sown in autumn. The "black bread" eaten by the peasantry of Russia and North Germany, and the rye-cakes of Sweden, are made from the rye which is very extensively grown on the sandy plains of those countries. Much whiskey is made from rye in the United States, and it is used with barley for making gin in Holland. Rye-straw is tough, and is not good for cattle, but is used for hats, stuffing beds, or thatching.

S

Sa′ble. [Fr., from Russian.] A small flesh-eating animal akin to the weasel, found in Siberia and northern countries, and valued for its glossy fur, which consists of a soft under-wool overtopped with longer hair. In summer the fur is brownish, with gray spots on the head and neck; but in winter it is deep rich brown and almost black. Winter fur is most valued, and is worn by ladies and by officials on their robes. The tail is made into artists' pencils and brushes. The sable spends most of the day in trees, and hunts at night. Its food is chiefly hares and small game. This animal is now getting scarce in Siberia, where it used to be hunted by Russian exiles.

Sa′bre. [Fr., from Ger.] A sword with a broad heavy blade, thick at the back, and curved slightly toward the point, used by cavalry.

Sac′charin or **Sac′charine.** [Fr., from L. *saccharum*, sugar.] Saccharin is a product of coal-tar, and it is said to be three hundred times sweeter than sugar. It is a valuable therapeutic, and has been recently used in the preservation of fruits.

Sad′dle. [AS., from root of *sit*.] A seat generally made of leather, fastened on a horse's back. The frame of the saddle is usually of wood and iron, made to fit the horse's back, and is called the tree. In the common saddle the tree is raised a little in front to form the pommel, and behind is a ridge called the cantel, the seat and flaps being made of tanned pig-skin. The stirrups are fastened to the tree. When the saddle is put on the horse, the girths are passed under the horse, and buckled tightly to straps. *Side-saddles*, used by women, have only one stirrup, in which the left foot is placed; and on the pommel are two horns, between which the right knee is placed.

Safe. [Fr., from L., *salvus*, safe.] A strong room or box for keeping money and valuables safe from fire and thieves. Safes are double wrought-iron chests, with plaster of Paris and mica or alum to resist heat. Burglar-proof safes are usually fitted with locks (*q.v.*) difficult to pick.

Safe′ty-lamp. A lamp for giving light in mines, covered with wire-gauze, to prevent the light from setting fire to explosive gas; called also Davy lamp. (See *Lamp*.)

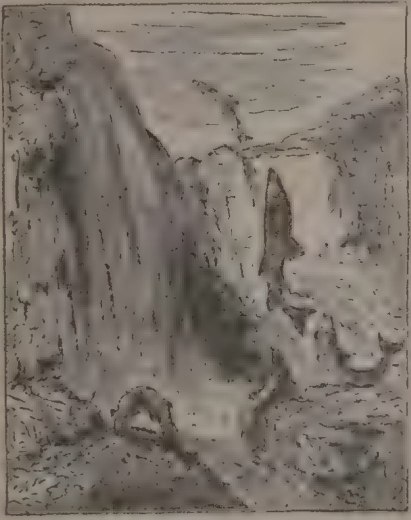
Safe′ty-valve. A valve in a steam engine arranged to permit the steam to escape when it exceeds a certain pressure. The valve is held in place by a weight attached to the end of a lever, and so adjusted that a fixed pressure of steam will lift it, and open a passage for the steam.

Saf′fron. A yellow coloring matter, obtained from the stigma, or flower centre, of a species of crocus. It is costly on account of the labor of picking the small stigmas. It has a pleasant perfume, and is used to color and flavor confectionary, cheese, and butter. Saffron tea is sometimes given to canary birds when shedding their feathers.

Sage. [Fr., from L. *salus*.] A grayish-green herb much used in cookery and medicine; so called from its supposed healing powers. It has a sweet smell and a bitter taste. The scarlet sage and Mexican red and blue sage are cultivated in America for ornament.

Sa′go. [Malay.] The prepared pith of a tree called the sago-palm, which grows in China, Japan, and the East Indies. The tree is cut down when fourteen or fifteen years old, the trunk split open, and the pith scraped out and washed in water. It is then squeezed through a sieve and dried, and is called pearl sago, and used for puddings. In 100 lbs. of sago there are 83 lbs. of starch. Much false sago is made in Germany from potato starch.

Sal′ad. [Fr., from Ital. *salata*, salted.] Raw herbs cut up and dressed with salt, vinegar, oil, etc., as a relish for food.



SALMON LEAPING.

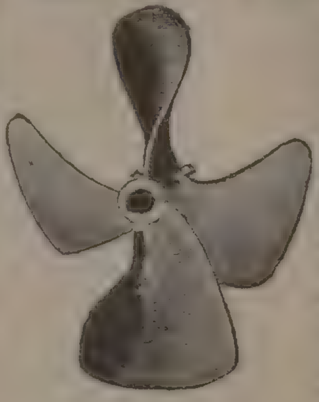
Salaman′der. [Fr., from L. or Gk.] A kind of reptile with four feet, long body, and long tail, but without scales. It is related to the frog, and was once supposed to be able to live in fire.

Sali′va. [L.] A liquid of an alkaline re-action which, secreted by the salivary glands from the blood, moistens the mouth and mixes with the food to help digestion. The salivary glands are excited to pour out saliva by the movement of the jaws in chewing and in talking. Touching any part of the mouth will cause saliva to flow. The sight, smell, or taste of food when one is hungry will "make the mouth water." When food is eaten hastily, and not moistened with saliva, the stomach is disarranged, and indigestion follows. Its action in digestion is due to the presence of ptyalin.

Salmon. [L. *salmo.*] A large fish much valued as food. Its color is bluish-gray, shading into a silvery-white underneath, and marked with black spots on the upper part of the body. Salmon are found on the European and American coasts of the Atlantic, passing up the rivers to deposit their eggs. On these journeys they pass waterfalls and other obstacles; but several British and Norwegian rivers contain salmon-leaps or fish-stairs, up which the salmon leap from step to step. After resting on the spawning-ground for eight or ten days, the females return to the sea. The eggs left in the gravel hatch out. The young fish increase little while in fresh water, but on reaching the sea they grow quickly. Salmon are now reared in farms or breeding-troughs, with fresh water flowing freely through them. A salmon usually weighs 10 or 12 pounds, but fish up to 30 or even 40 pounds have occasionally been caught. Salmon-trout and bull-trout are two kinds of salmon. *Parr* are salmon fry; *smelt* is a young salmon; *grilse*, a young salmon returned from the sea. The common salmon of Europe and the Atlantic is the *Salmo salar*. The salmon of the North Pacific belongs to a different genus, the *Oncorhynchus;* and the quinnat, the largest of these, does not feed in fresh water, and dies after spawning. They are caught in immense numbers in the rivers from California to Alaska, many millions of pounds being canned annually.

Salt. [AS.] A substance found in the earth, and very abundant in sea-water, used for seasoning and preserving food. It is composed of sodium combined with chlorine. Salt is important as an article of food, and the lower animals like it; farmers place lumps of rock-salt in their fields for the sheep and the cows to lick. In North America there are certain places where the rocks contain much salt, and wild animals flock in great numbers to these places, which are known as "salt-licks." Salt forms solid beds in the crust of the earth, just as coal does; and in this state it is known as *rock-salt*. Rain-water, sinking into the ground, dissolves much of the rock-salt; and if a well be dug down to this salt water, it can be pumped up, and the salt obtained from it by evaporation crystallizes in cube shapes. The salt water is called *brine*. Salt can also be obtained by evaporating sea-water. In the Carpathian Mountains there are beds of salt from 600 to 700 feet thick. Near Cracow there is a wonderful salt-mine over a thousand feet deep, divided into floors, galleries, and passages, all of salt. One division is so like a church that it is called St. Anthony's Chapel. It has an altar, pulpit, and statues. Another room has a tomb made of salt. The passages are estimated to extend 300 miles. Rock-salt is abundant in many parts of the United States, and great quantities of brine are pumped up and evaporated in New York. Large deposits exist in Michigan, Louisiana, Utah, Nevada, and elsewhere.

Salt′petre, Nitre, or **Rock-salt.** [Salt; and Gk. *petra*, a rock.] A kind of white salt made up of nitric acid and potash, often found oozing from rocks. It is bitter in taste, and is called potassium nitrate. It is found in caves or got from the soil in Egypt, Persia, and India. Its principal use is in making gunpowder and in preparing nitric acid, sulphuric acid, in making fireworks, and medicinally for rheumatism. *Chili saltpetre* is a sodium nitrate, which cannot be used in making gunpowder, but from which nitric acid is got.



SCREW PROPELLER.

Salts. Salts, in chemistry, are the neutral or other compounds formed by the union of an acid and a base.

Sand. [AS.] Fine particles of stone on the seashore or in deserts, made by the wearing out of rocks, especially of quartz, silica, or flint. River-sand and sand from pits are usually sharper than sea-sand. The colors of sand are made by various oxides of iron. Sand is used in making glass, mortar, cement, sand-paper, molds for casting, and in sawing stones and grinding cutlery.—*Sand-blast* is a stream of sharp sand let fall from a high box on a plate of glass to cut it and make it look like ground glass. Metals and stones may also be cut by the sand-blast. The parts not requiring to be cut or engraved are covered with leather, paper, or wax.

San′dalwood. [Fr., from Sans., and *wood.*] A yellowish heart wood of trees in the East Indies and the Hawaiian and South Sea islands. It has a pleasant smell.

Sand′piper. A numerous family of game birds living on the sea-shore. The European kinds include the common sandpiper, called also summer-snipe, the dunlin, the knot, and the ruff. Some small plovers are called sandpipers. In North America are the pectoral, the purple, the red-breasted, and the spotted sandpipers.

Sand′stone. A rock of sand pressed together. Old and New Red Sandstone are two extensive series of British rocks, the one below and the other above the coal-measures. The terms Permian and Triassic have taken the place of the name New Red Sandstone. *Flexible sandstone* is a fine-grained variety of itacolumite, which, owing to scales of mica, is quite flexible.

Sand′wich. Two thin slices of bread with meat, cheese, or butter between them; first used by the Earl of Sandwich in the 18th century so that he need not leave the gaming-tables.

San′talin. A substitute for butter extracted from suet.

Sap. [AS., *saep.*] The fluid which flows through plants. The raw or crude sap consists of much water, with plant-food dissolved in it, entering through the roots. It rises through the outer part of the stem into the leaves, and is there converted into various non-nitrogenous substances, composed chiefly of carbon, hydrogen, and oxygen, such as starch, gum, sugar, cellulose, and oil. In the sap there are also formed substances containing nitrogen, such as albumen and gluten. These substances are distributed to every part of the plant, helping to form and to fill new cells, and so aiding the life of the plant.

Sap′phire. [Fr., from Gk., from Heb.] A precious stone of a bright-blue color, next in hardness to the diamond, and next to the ruby in value. It is composed of alumina, colored differently. The red sapphire is the Oriental ruby, the green sapphire is the emerald, the yellow the topaz, and the violet is the amethyst. Colorless or white sapphires are sold as diamonds. The finest blue sapphires come from Ceylon.

Sar′dine. [Fr., from L. *sardina.*] A small pilchard or herring found near the island of Sardinia, and preserved in oil for food. It has a slim body, and is greenish blue on the back and silvery white below. It is also caught off the north-west coast of France and in the Baltic. American sardines are young herrings or menhaden. The sardines appear in large shoals in spring, and are caught in nets which are large enough to let their heads through, but catch them by the gills and fins. They are washed, scraped, salted, heads and gills cut off, washed again, and dried. They are then cooked in olive oil and dried again, and then packed in tin cases with boiling oil. Sprats, roach, and dace are sometimes put up in this way.

Sarsaparil′la. The dried roots of several American climbing evergreens, reaching from Mexico to South America. It is much used as a medicine. There is none of it in the sarsaparilla syrup drank in soda water.

Sas′safras. [Cor. from *saxifrage*, which now denotes a different kind of plants.] A kind of tree or plant, with aromatic properties, of the laurel kind, and allied to cinnamon, cassia, and camphor. Every part of the plant has a pleasant fragrance and a sweetish aromatic taste, which is strongest in the bark of the root. It occasionally grows to a height of 50 or 60 feet, and has a grayish and deeply-furrowed trunk. It is sometimes called the *ague-tree.* Its bark is used in dyeing, but also especially the bark of the root medicinally for rheumatism. The leaves are used in making root beer. The wood is tough, and does not decay.

Sat′in. [Fr., from L. *seta*, silk.] A kind of closely-woven silk cloth with a glossy surface. It is an elegant material. The woof, or cross-wise threads, passes over several threads of the warp at a time. The fabric is then passed between heated iron rollers, which give a smooth, glossy appearance.

Sat′in-wood. A hard fragrant wood like yellow mahogany, from the East and West Indies. It takes a lustrous finish, and is used in cabinet-work.

Sat′urn. The planet next beyond Jupiter, and almost twice as distant, it being 875,000,000 miles from the sun. In size it comes next to Jupiter, its diameter being 73,000 miles. Its year is equal to nearly 29½ earthly years, and it rotates on its axis in 10 hours. In addition to its nine moons—one of them recently discovered—it has a remarkable feature in its two—or perhaps five—wonderful rings, which surround it at a distance of some 20,000 miles. These rings are supposed to be made up of meteors rotating in company around the planet.

Savan′nah. An extensive open grassy plain in the Southern States. (See *Prairie.*)

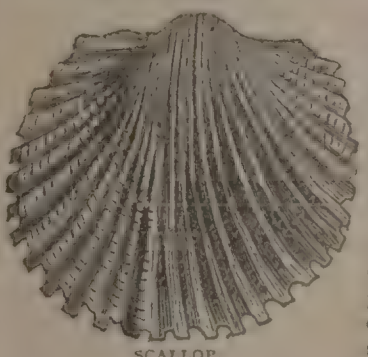
Sauer-kraut. A salted preparation of cabbage much esteemed in Germany, and largely used in the United States. It is thought to be very wholesome and easily digested, and is prepared in large quantities for winter use.

Savoy′. [Fr.] A kind of cabbage with curled leaves, originally from Savoy, much cultivated for winter use.

Saw. [AS. *saga*, from L. *secare*, to cut.] A thin steel blade with sharp teeth on its edge for cutting wood, etc. The chief kinds are the hand-saw, the cross-cutting saw, and the circular-saw, which is worked by machinery. The blades are of steel, the teeth being punched out by machinery, then ground and set and cleaned by emery. The *saw-gin* is the same as the cotton-gin, used in clearing the cotton fibre of its seeds.

Saxi′frage. [L. *saxum*, stone; and *frangere*, to break.] A kind of plant growing in the crevices of rocks or on high hills, once supposed to have the power of dissolving or breaking stone in the bladder. They are mostly perennial herbs.

Scale. [AS. *shell* or *husk.*] One of the thin plates covering the body of a fish or of a reptile. Ganoid scales of fish like the gar and sturgeon are an inner layer of bone and an outer layer of shining enamel arranged to form a coat of mail. The Perch family have comb-like scales. Those of the herring and salmon are thin, with concentric lines of growth, and serrated on the margin, and are called cycloid scales.


SCALLOP.

Scale. [L. *scala*, a ladder.] A scale in music, is a series of tones from the keynote to the octave. A *chromatic scale* includes 8 tones and 5 half-tones. A *diatonic* or major or minor scale has eight sounds or tones.

Scal´lop. [Old Fr.] A shell-fish radially ribbed, and having the edges of its two-valved shell formed into a series of small curves. The shell is light, and the fish has a little air-bag which enables it to float. It abounds on the English and American coasts, and on the shores of Palestine. Formerly the shell was used to cook oysters in. An edible scallop is found on the Atlantic coast of the United States. The shell of the Palestine species was formerly worn by pilgrims to show that they had visited the Holy Land.

Scar´let-runner. A bean-plant with scarlet flowers which clings to and runs up any support it can reach.

Schoon´er. [AS., to glide.] A vessel with two or more masts, fore and-aft rigged, or square-rigged on the fore-mast top-sail. The first schooner is said to have been built in Massachusetts in 1713.

Scis´sors. [Old Fr.] A pair of blades movable on a pin through the middle of both, which cut when the sharp edges are pressed together. The best are made of cast steel or shear steel. Often called a pair of scissors.

Scor´pion. [L.] An arachnidan somewhat like a lobster, having a poisonous sting in its tail. It has a flattened body, and a long, slender lower abdomen, formed of six movable segments, the last of which ends in its sting. Its poison causes pain, but is seldom destructive of life. Scorpions are found in warm climates.

Screech-owl. An owl which utters a shrill cry, and is also called the barn-owl. The screech-owl is small, and of a gray or reddish color.

Screw. [Old Fr.] A round piece of wood or metal with a sloping ridge called a thread running round it for fastening things together. As a mechanical power the screw is a modification of the inclined plane. The flipper of the sea-bear, the wing of the insect, of the bat, and of the bird are screws in principle, resembling the blade of the propeller, and they twist and untwist during oscillation.

Screw′-driver. A tool for driving in screws It has a thin end to enter in the slot or nick in the head of the screw.

Scut′tle. [AS , from L. *scutella*, a tray.] A broad basket or a vessel for holding coals. In nautical phrase, a small opening or hatchway in the deck of a ship large enough to admit a man.

Scythe. [AS.] A large curved blade fastened to a long handle, for cutting grass, corn, or crops on small farms. Scythe-blades are forged, and then ground on grindstones. The haft is made of bent wood, with two handles.

Sea. [AS.] A large body of salt water smaller than an ocean, though the term is often applied to the whole ocean. The ocean covers nearly 8-11ths of the area of the globe, and its depth averages 2,000 fathoms. The salts in the sea are on an average 3½ per cent., the remainder being water. Of the salts, nearly 78 per cent. is chloride of sodium, 11 per cent. is chloride and bromide of magnesium, and 10 per cent. sulphates of lime, magnesium and potash, with a very small quantity of carbonate of lime. The usual tint of the sea is bluish-green; but the color of the soil or the color of the sky, and other local circumstances, produce many variations The sea is inhabited by a vast number and variety of animals, from the simplest forms to the fish, reptiles like the turtle, and mammals like the whales and seals. Many forms are found at great depths in the water, some of these being phosphorescent; some are blind, others have very large eyes. There are also many small phosphorescent animals on the surface, so abundant in places that the ocean seems like a sea of fire.

Sea′-anemone. (*Actinozoa*, or ray-like animals.) A soft, pulpy polyp with a flower-like or ray-like fringe of tentacles, in the middle of which is the mouth, leading into a hollow sac or stomach. It is of the shape of a column, with a sucking surface in the base that enables it to move much like a snail, but more slowly. From the tentacles are thrown small darts, by which it seizes any crab or worm or small fish for food.

Seal. [AS., from L. *sigillum*, a seal.] An engraved stamp for marking wax or wafer to confirm or make sure.

Seal. [AS.] A flesh-eating animal found in great numbers lying on the icebergs or swimming in the waters of both north and south polar regions. Their sharp-pointed teeth enable them to catch the slippery fish on which they feed. The different kinds of seals vary in size and in the color of their fur. The head, shoulders and chest are round, and the body tapers towards the tail. All their feet are webbed; but the webs of the back feet can be folded up like a parasol, so that they are able to lie close to the body. The webs of the front feet are always stretched out. As the seal lives almost entirely in the water, it has the power of closing both its eyes and its ears. Its body, too, is thickly covered with

SOLAR CORONA.

double fur, which is kept constantly oiled, so that the fur next the body is never wet. Several species are much hunted for their oils and skins, including the common seal, found in the Atlantic and the Pacific, and the harp seal, abundant in Arctic waters. There are other species in the north Atlantic, while in the southern ocean is found the great sea-elephant, so called from its size and the elongation of its nose into a short proboscis. The males of this species are 20 feet long, the females little more than 10 feet. There are other species known as sea-leopards in the southern waters, while in the north Pacific are the sea-lions and sea-bears. Both of these have long hair, but the sea-bears have also a soft and delicate fur, which is highly valued as the seal-skin of commerce. The northern fur seal has its breeding grounds on some small islands in the Behring Sea. These belong to the United States, and only a limited number are permitted to be killed yearly. The killing of these seals in the open seas by Canadian seal fishers, gave rise to a serious international question between Great Britain and the United States.

Seal′ing-wax. Wax used for sealing letters or for being marked with a seal. Gummed envelopes have almost taken the place of wax for closing envelopes. Wax is made of lac mixed with turpentine and resin; black wax is colored with ivory black, and red with cinnabar.

Seanettle. A jelly-fish or medusa.

Seaurchin. (*Echinus.*) A kind of shell-fish or sea-egg covered with prickles like a chestnut bur, and closely related to the star-fish. The shells are of the thickness of egg-shells, and have rows of dots or knobs with lace-work between, and are made up of hundreds of plates joined like mosaic work. The animals do not cast their shells like crabs, but the flesh secretes lime from sea water, and deposits it round the plates, which increase uniformly. The spines are beautifully carved columns with ball-and-socket joints on the knobs. There are also protruding through holes double rows of tube-like feet, which are supplied with water by a tube opening at the top of the shell. In the centre of the shell is a tube-like stomach opening to the top of the shell. The sea-urchin has also a mouth, intestines, heart, and five teeth. There are many kinds.

Search-light. An electric arc-light of great candle-power, used with a parabolic projector which throws its rays for many miles. It is of great importance on a naval vessel, in enabling the captain to discover an approaching enemy at night. One shown at the Chicago Exposition of 1893 could be seen 85 miles away, and fine print was read by its light at 8 miles' distance.

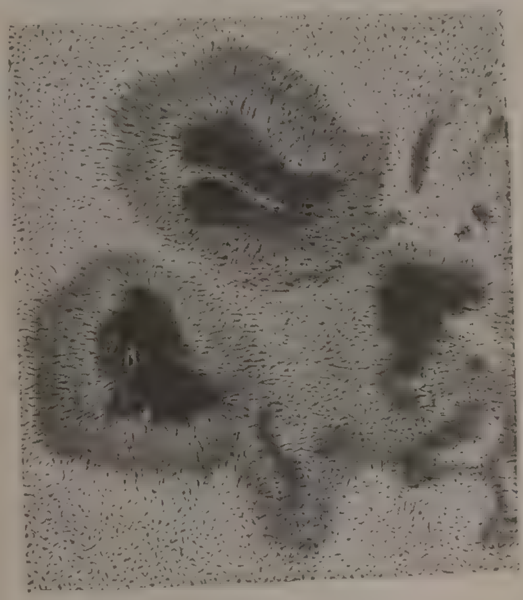
Sec′retary-bird. The crane-vulture of South Africa and the West Indies. It is easily tamed, but attacks and kills poisonous snakes. Its tail is very long, with two long middle feathers. It has a crest on the back of its head of six pairs of feathers, like the pens behind the ears of a clerk, hence its name.

Secre′tion. A substance separated by any one of the glands from the blood, either to be used for some purpose in the body or to be discharged as useless and detrimental. Some of the secretions are sweat, saliva, bile, and milk.

Sedan′. [From *Sedan*, a town in France.] A covered chair for one person, carried by two bearers on poles with the hands, and differing from palanquins, which are carried on the shoulders. There are no carriages in the streets of Canton, their absence being supplied by nimble sedan bearers. Sedans were introduced into England in the seventeenth century.

Sedge. [AS.] A kind of coarse grass with blades shaped like swords, and found in swampy ground. It has a triangular jointless stem, spiked inflorescence, and long leaves, rough on the margin and mid-rib. There are several hundred species.

Seed. [AS.] The part from which a new plant grows, consisting of one or more coats or skins and the kernel, which is made up of the embryo and albumen to feed the embryo. Some albumen often forms a part of the embryo. Embryos are divided into those with one cotyledon or seed-leaf, as grasses; those with two cotyledons, as the bean; and those with more than two, as pines.


SUN SPOTS.

Seid′litz. [From *Seidlitz*, in Bohemia.] A natural mineral water; also a powder having the same effect. The seidlitz owes its aperient property to the presence of Epsom salts (*q.v.*) and a little lime. Seidlitz powder has 2 drams of Rochelle salt and 40 grains of bicarbonate of soda in one paper, and 35 grains tartaric acid in another paper. When mixed these effervesce, and make a very pleasant draught.

Selt′zer. [*Selters.*] A mineral water from Selters, in Nassau, Germany. Its chief character is a large amount of carbonic acid in combination with alkaline carbonates, and also some common salt. It is useful for dyspepsia.

Sem′aphore. [Gk.] A means of signaling invented by Chappe in 1793. Formerly in railway signaling there were three positions: at right angles meant stop; at half a right angle, go slowly; hanging down, that the line was clear. Nowadays semaphores have two positions: when the arm is up, danger; when down, clear.

Sen′na. [Arab.] The dried leaves of a kind of cassia used in medicine as a valuable purgative. It grows abundantly in North Africa, in the West Indies, and in India. Egyptian senna has a high reputation. The leaves are long, lance-shaped, or broad, and are sometimes mixed with angel leaves, which have no veins. Epsom salts mixed with senna is called *black draught*, and is a strong purgative.

Sen′sitive-plant. The *mimosa*, a small plant with leaves which collapse and fold up when touched. It is a native of the American tropics, and is about a foot and a half high.

Se′pia. The cuttle-fish, a family of naked molluses, with an oval body and with eight short arms surrounding the head, also two long arms or tentacles. It has an internal shell or plate along the back, known as *cuttle-fish bone.* It also possesses a bladder containing a black liquid, which it ejects when pursued, staining the water black so that it can escape. This secretion, obtained from the ink-bag and dried, is used as a pigment called India ink. This, when dissolved in potash, boiled and filtered, precipitated by an acid, and dried, becomes the pigment *sepia.*

Sequo′ia. The giant trees of California. They belong to the family of the pines, and are distinguished by their enormous dimensions, one of them having measured 112 feet in circumference and supposed to have been 450 feet high. The California redwood is a smaller species.

Serge. [Fr., from L. *sericus*, silken.] A kind of twilled cloth, first made of silk, now chiefly of wool, used for garments.

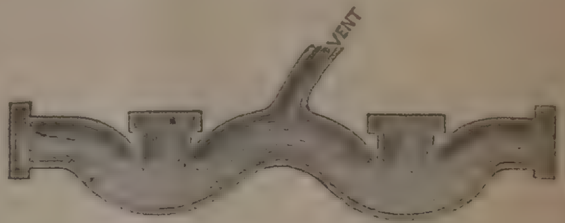
Ser′pent. [L. *serpens*, creeping.] An animal that creeps or winds about on the ground. They are divided into two classes—poisonous, as vipers and rattlesnakes; and snakes that are not poisonous, as boas, pythons, and many others. Serpents are vertebrate animals, without limbs, but some have rudiments of hind limbs. (See *Reptile*, *Snake.*) They are mostly long and slender, and move partly by bending the body into folds, and partly by clinging with their scales to rough surfaces. Many glide, others burrow, and some live in trees.

Ser′pentine. A magnesian rock, usually of a greenish color, sometimes spotted like a serpent's skin. Precious serpentine is translucent, and of a rich oil-green color. It is really chrysolite altered.

Set′ter. A dog taught to set or crouch when it sees the game. Originally it was a cross between a spaniel and a pointer.

Sew′er. [Fr.] A drain or passage to carry off sewage in cities. In Paris the sewers contain telegraph and telephone wires, compressed air or gas-pipes, etc. The ancient sewer (*Cloaca Maxima*) of Rome was large enough to allow a loaded wagon of hay to pass through. Sewerage has become a very important part of modern city administration.

Sew′ing-machine. A machine for sewing, of which the first effective one was introduced by Elias Howe in 1846. The Howe machine has a needle with an eye near the point. The thread carried through the cloth by this needle forms a loop under the cloth through which a shuttle passes. The shuttle contains a bobbin of thread, which unwinds as it passes through the loop, and the thread thus put through forms the lock-stitch. In addition to machines for ordinary sewing, there are many special inventions. The most important is the cylinder, with cylindrical feed, for shoe-work, gloves, pocket-books, and traveling-bags. Sewing-machines are now produced that make 2,000 stitches a minute. The button-hole machine can make 1,200 stitches per minute. Sewing-machines are usually fitted with a treadle, to be worked by the foot.



DOUBLE TRAP FOR SEWER.

Sex′tant. [L. *sextans*, a sixth part.] An instrument for measuring angles, mounted on a frame, and marked with degrees, minutes, etc. It is constructed on the same optical principle as Hadley's quadrant.

Shad. A fish of the Herring family, but, unlike the herring, with a deep notch on the middle of the upper jaw, and without teeth on the tongue and the roof of the mouth. The Chinese shad is an esteemed food-fish. The European shad is little valued for food. The American is the choicest of food-fishes, and ranks highest among American fishes. It is twenty inches long, is bluish and silvery in color, and is found abundantly in the rivers of the Atlantic coast of the United States.

Shad′dock. A fruit of the Orange and Lemon family, but much larger. It is native to China and India, but is now grown in the West Indies. It is better for preserving than eating, though now, under the name of grape-fruit, it is much used as a dessert fruit.

Shagreen′. A kind of leather made from the skins of horses, wild asses, and camels, and so grained as to leave on it little grains or pimples. These are caused by forcing into the moist skin the hard seeds of an Asiatic plant. Shagreen is made at Astrakan, Russia, and other places. It is used for covering sword scabbards, instrument cases, etc.

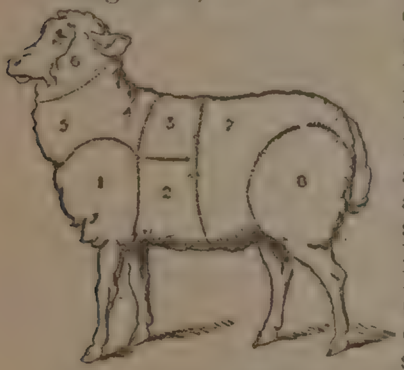
Shale. [Ger., akin to *scale.*] A rock easily split into slabs. Bituminous shale is impregnated with bitumen, and often accompanies coal.

Sham′rock. [Celt.] A three-leaved plant like clover; the national emblem of Ireland.

Shark. A large, fierce, and powerful fish, called the tiger of the ocean. It sometimes reaches a length of 35 feet. It has a strong, stout body, and a tail of irregular shape, its upper section being longer than its lower. Its skeleton does not consist of bone, but of hard gristle; instead of scales its skin is set with hard knobs, and the gill slits on the side of the neck have no covering. Its mouth is on the under side of its head, and it has to turn before biting. It has several rows of teeth pointing backward and imbedded in the lining of the mouth. The female lays two eggs, with leathery cases, that have strings at each of the four corners. (See *Egg.*) The sharks are voracious, and in nearly every case carnivorous. Some sharks, as the basking shark and the whale shark, grow to an enormous size. Most sharks are harmless to man, but some species, as the white and the blue sharks, will attack and devour man. Another species, the man-eater shark, found in all tropical and temperate seas, grows to a length of 36 feet.

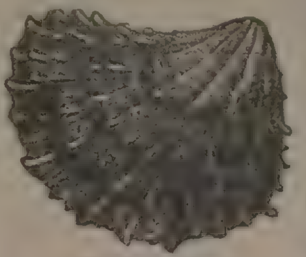
Shawl. [Per.] A woven or knitted covering for the shoulders, of wool, cotton, silk, or other textile material. India shawls are made from the wool of the Cashmere goat.

Shears. A large pair of scissors used for cutting wool from sheep or their skins, also the nap of cloth. *Shear steel* is prepared from blistered steel by repeated heating, rolling, and tilting to increase its malleability and fineness of texture. Two or more poles fastened together at or near the top, and steadied by a guy from which pulleys and ropes are hung for lifting weights or unstepping the lower masts of ships, are called shears.



Sheep. [AS.] A most useful ruminant animal, bearing wool, and valued for its flesh. The domestic sheep is gregarious and very timid. Among fine wool sheep are the merino, the French, the Saxon, and Silesian; among coarse-wool sheep are the South Down, Cotswold, Leicester, and Cheviot. The meat of the fine-wool sheep is not as good as that of the coarse-wool sheep. The merino sheep is a native of Spain, and valued for its wool. It is now much bred in Saxony, Silesia, Bohemia, and Australia, while in the United States the sheep are 95 per cent. merinos. The merino differs from the English sheep in having wool on the forehead and cheeks. It is a large breed, with heavy horns, and with fine wool curling in tendrils. The Cretan sheep has long horns; the Turkish sheep has a long fat tail, which has often to be supported; the Asiatic sheep has four horns; the Rocky Mountain sheep, a wild species, is called *big-horn*. from its large-sized horns. The aoudad is an African sheep, having a long mane on the breast and fore legs. The argali and mouflon are wild sheep in Siberia and Sardinia respectively. The musmon is a wild species in European Turkey. The most common mode of cutting up a sheep is—(1) shoulder, (2) breast, (3) loin (best end), (4) best end neck, (5) scrag end neck, (6) head, (7) loin (chump end), (8) leg.

Shell. [AS.] The outer part of an egg or nut, the pod of peas, and the hard covering of some kinds of ocean animals. Shell-fish are usually univalves, having one part; or bivalves, having two parts joined with a hinge. Shells are useful for protection, and their strength and thickness are generally in proportion to the dangers to which the animal is exposed. Those inhabiting shallow places near the shore and exposed to the beating of the waves have stronger shells than those living in deep water. Fresh-water molluses generally have delicate shells. The thin layers of the oyster-shell are deposits of shelly matter showing the lines of growth. All living shells have an outer layer of animal matter called epidermis, and they have no lustre till this is taken off. Mussel-shells show beautiful blue tints when the epidermis is removed. The bodies of all shell-fishes are enclosed by a delicate membrane called a mantle, which secretes the shell. Among other animals the tortoise has a shell, whose upper part is made of the flattened spines of the vertebræ, and of the ribs, the shelly plates being merely portions of the skin hardened into shell. (See *Tortoise.*) There are many other animals that form shells, some of them being microscopic. Chalk is largely made up of the shells of these.



SPINY SHELL.

Shel′lac. [*Lac*, gum.] Lac or gum hardened and cut into thin plates. (See *Lac.*)

Sher′ry. A kind of light-colored wine, chiefly got from Xeres in Spain. It is colored a straw color or amber color by mixing cheap wine and boiling it down.

Shield. [AS.] A frame covered with skin or metal, worn on the left arm to keep off blows; also the escutcheon or field on which are placed the bearings in coats of arms.

Shil′ling. [AS.] A silver coin of the value of 12 pence or twentieth part of a pound.

Shin′gle. [Cor. from L. *scindula*, a wooden tile.] A thin piece of pine, cypress, cedar, or oak used as a roof tile; loose stones on the sea-shore or in the bed of a river.

Shin′gles. [L. *cinguium*, a girdle.] A disease which spreads round the body like a girdle.

Ship. A large sea-going vessel with masts and sails, particularly one with three masts rigged with square sails. It is made up of hull, deck (*q. v.*), masts, yards, bow-sprit and rigging, ropes and chains. The front mast is the foremast, the middle mast the main-mast, and the hindmost the mizzen-mast, and when a fourth is used, the jigger. A full-rigged ship has from 21 to 24 sails, and a four-masted ship as many as 36 sails.

Ship′worm. A mollusc of unusual shape, whose scientific name is the *Teredo*. It looks like a worm, being long and slender in body. It bores with its cutting shell into wood, and often so riddles ship timbers with holes that they crumble at a touch. At one time these animals destroyed the piles which protected Holland from the sea, and a deluge was averted only by great labor and expense. They make long tunnels in wood which never break into one another.

Shod′dy. A fibrous fabric made of material obtained by tearing refuse woollen goods, stockings, rags, or druggets.

Shoe. [AS.] A covering for the foot, usually of leather. Fine shoes are made by the hand and shaped on a last, or are made by machinery. Shoes are largely made by machinery in the Eastern States of America, New York, and Philadelphia. *Wooden shoes*, much used by the peasantry of Europe, are cheap, durable, and comfortable, though clumsy. Shoes made of vulcanized rubber, as a protection against dampness, are much worn as over-shoes.

ANCIENT SHOES OR SANDALS.

Shot. [AS.] Bullets or small pellets of lead shot from a gun. In war, some are composed of lead, wrought iron, or cast iron; they are spherical or oblong, and include hollow, solid, and case-shot. Chain-shot was formerly used in naval warfare to destroy rigging. Shrapnel shell is a projectile for a cannon, consisting of a shell filled with bullets and a small bursting charge to scatter them at any point while in flight.

Shov′el. [From *shove*.] A broad, slightly-hollowed blade with a handle for lifting and throwing earth, coal, grain, or other loose substances. A *steam-shovel* is a machine with a scoop or scoops, worked by a steam-engine, for excavating the earth in railway cuttings.

Shrew-Mouse. An animal brown in color, and very like a common mouse, except that the nose is much longer and more pointed, the stomach is white, and the tail is square instead of round. These little creatures are treated very cruelly. In some places many people believe that the bite of a shrew is poisonous, and that if one merely runs over the foot of a man or an animal sickness or even death will follow. The American water-shrew has fringed feet. The old Egyptians worshipped the shrew. Many mummies of this little creature have been found in their temples. In Scotland it is sometimes called the ranny; and also the fetid mouse, it having a musky smell, so strong that cats will not eat it, though they kill numbers. Like the mole, it makes long tunnels under the earth in search of food; but it makes its nest above the ground in any little hole it can find. Some of them are the smallest of all mammals.

Shrimp. [O.E.] A small crustacean, used as food, with a thin body, long feelers, and 38 legs of different lengths. Between its head and tail it has thin shells in six parts, jointed, and each working into its neighbor. Its tail is wing-shaped, and helps it to swim or jump through the water, and can be expanded or folded up. The larger kinds of shrimps are called *prawns*.

Shrub. [AS.] A tree-like plant or bush with no trunk but with several stems branching directly from one root.

Shut′tle. [AS.] That by which the weaver shoots or throws the thread from one side of the web to the other. The *shuttle race* is a shelf in the loom beneath the warp along which the shuttle passes.

Shut′tlecock. A cork with feathers, driven back wards and forwards by a light bat in the game of shuttlecock and battledore.

Sick′le. [AS.] A curved steel knife for cutting grain. The sickle has one side of the blade notched, so as always to sharpen with a serrated edge. The reaping-machine has now taken its place in harvesting operations. A grass hook or sickle is used for trimming grass borders or lawns where mowers cannot be used.

Sien′na. A reddish-brown pigment made from earth got from Sienna in Tuscany. This clay is colored by the oxides of iron and manganese. *Burnt sienna* is the same clay made redder by the action of fire.

Sieve. [AS.] A vessel with small holes in the bottom for separating fine particles from coarse ones. It is usually shallow, with the bottom made of wire, hair, or woven into meshes.

Sil′ica. [L.] The substance of which flint, sand, and sandstone are chiefly composed. It is the oxide of the element silicon, and is very abundant in the form of quartz. *Silicates* are salts of silica or silicic acid.

Silk. [AS., from L. *sericum*, silk.] Fine threads spun by silk-worms, but especially the *Bombyx mori*. The silk-worm was first kept in China for the purpose of manufacturing silk. From silk-worms' eggs, in about a fortnight, little caterpillars two inches long and light-colored come out; these must be fed with mulberry (*q. v.*) or lettuce leaves. In about a month the caterpillars reach their full size, and inside their bodies is a sticky substance which they convert into silk. From two little holes in its head each caterpillar draws out flossy threads of the sticky matter, and twists them together by means of a gum, winding them round and round its body until it is enveloped in a ball of silk, called a *cocoon*, which is about as large as a grape or a pigeon's egg. The cocoons from which silk is to be obtained are heated in an oven, and the inner balls are thrown into warm water, so as to melt the gum; after which the silk from them is wound upon reels, and then made up into hanks. It is then known as *raw silk*. The thread of a single cocoon generally measures about 600 yards, but some cocoons have measured 1,200 yards. The silk fibre is sent to the factories, or silk-mills, as they are called, where it passes through the processes of winding, cleaning, twisting, weaving, dyeing, and finishing. Silk is made into silk for dresses, satin, velvet, ribbon, sarcenet, stockings, fringes, buttons, gloves.

Silk-worm. The worm which spins or produces silk threads. For thousands of years the Chinese would not allow the eggs of the silk-worm to go out of the country. About 550, two monks are said to have brought to Europe a few eggs hidden in their canes. Now it is quite domesticated, and has been so long fed by man that the female is nearly as motionless as if she had no wings, and the male merely flutters without leaving the ground.

Sil′ver. [AS.] A soft, white, shining metal which takes on a bright polish. It is found in combination as sulphurets and oxides, and with other metals. It is widely diffused. Of mineral ores associated only 1 in 17 is free from silver, and traces of it have been found in sea-water and in organic substances. Gold never occurs in nature apart from silver, and is also found with lead; yet there is a natural distinction between the veins of the several metals. The main sources of the world's supply, after the discovery of America, were Mexico and South America; but the United States on the Pacific slope now yields silver in excess of any other country.

Si′phon. [Gk.] A bent tube, with one arm longer than the other, for drawing off a liquid from one vessel to another at a lower level, the shorter arm being inserted in the liquid at the higher level.

Skate. [Scand.] A large flat fish more or less square in form, and the thinnest of ray fishes in proportion to its bulk. It is the largest of ray fishes. The European blue or gray skate is used as food, and sometimes weighs as much as 200 lbs. The American smooth or barn-door skate is also a large species, measuring often 3 feet across. Its nose is conical, and it has sharp spines above its eyes. Its jaws are covered with small, sharp-pointed teeth.

Skeleton. [Gk. *skeletos*, dried.] The bony framework of an animal body. That of the human body is composed of 246 separate bones. At the joints the bones are joined together by bands of a substance like gristle. The use of the skeleton is to form a foundation—a kind of stiff framework—on which the rest of the body can be built up. The bones of the head enclose and protect the brain; the bones of the trunk perform a similar office for the organs situated in the chest and the abdomen; the bones in the limbs impart rigidity to them, and aid us in performing work and in moving about. (See *Bone.*)

Skin. [Scand.] The natural covering of animals and plants. The thickness of the skin varies in different parts of the human body, from one-eighth to one-fourth of an inch. On the hands and feet it becomes thick (or callous), but in other parts it is thin and delicate, while at the ends of the fingers and toes it grows into thin plates called nails. The hairs are only portions of the skin grown very long and narrow. The skin is composed of *two layers:* there is a lower, thick layer, full of the fine blood-vessels called capillaries, and full, too, of nerves—this layer is called the *dermis;* upon it lies an upper, thin layer, of a horny or scaly nature, in which are *no* blood-vessels and *no* nerves—this is called the *epidermis.* Just under the dermis there is usually a layer of fat. When we examine the outside of our skin through a magnifying-glass, we can see great numbers of little holes or pores. No fewer than 5,000 pores have been counted in the skin forming the tip of a finger; and there are about 2½ millions of such pores in the skin of the whole body. Each pore is the end or opening of a tube called a sweat gland, which goes down, through the epidermis, into the dermis, where its lower end is coiled up into a little ball or knot. The oil glands are very similar to the sweat glands. Two are attached to each hair; and when the skin is in a healthy state this natural oil ought to be sufficient for the hair. The oily matter formed by these oil glands runs out on the skin and mixes with the sweat. The sweat produced by the skin of an ordinary man or woman every twenty-four hours measures not less than a pint and a quarter, weighing 1½ lb.

Skull. [Scand.] The bony case which encloses the brain, and with the bones of the face and mouth gives shape to the head. It is rounded on the top somewhat like the large end of an egg, and in front and on the sides it has openings for the eyes, the nose, and the ears. The skull is made up of compact plates, joined by irregular saw-like lines or projections called sutures. The upper jaw and the bones of the nose and cheeks belong to the skull, and are immovable. The use of having the skull in several parts is to allow the brain to grow, and to prevent a jar from affecting the whole skull. In many fishes the skull is almost wholly cartilaginous, with a layer of spongy bones.

Skunk. [Ind.] An animal of the Weasel family, found only in America. There are eighteen species, of which the common skunk is found in the rocky parts of North America. It defends itself by giving out liquid secreted in two glands near the anus, the scent of which is so nauseous and persistent that it forms an effectual defense against other animals. It is about the size of a cat, with a broad body standing low on the legs. Its fur is coarse, the hair long, and the tail long and bushy. The claws on the fore feet are strong and suited for digging. It preys on mice and frogs. It does not run from its foes, its elevated white tail being a sufficient warning to all carnivorous animals, none of which will attack it. The common skunk is black, with white on the body and tail. The spotted skunk of Mexico is smaller, and is also marked with black and white. The skunk is hunted for its fur, which is in considerable demand, but the hunter must be careful to avoid alarming the animal and causing it to discharge its obnoxious secretion.

Sky'lark. A bird which nests in the grass, but rises high in the air, singing as it rises. (See *Lark.*) The Australian skylark is a pipit, and though it rises it lacks the song of the true lark.

Slag. [Scand.] The dross of melted mineral, or cinders from a volcano.

Slate. [Fr.] A kind of rock which splits into thin layers very readily. The largest slate quarries in the world are in Wales. Welsh slates are lightest and best. They are used for covering roofs, for cisterns, for mantelpieces, and for writing upon. Slate is very useful for roofing purposes, since it is cheap, light, and impervious to water. Slates are fastened to the rafters with nails, and are placed so as to overlap one another.

Sling. [AS.] A strip of leather, having a cord attached to each end, for throwing stones by rapidly whirling round the head and suddenly letting one of the ends go; also a bandage hung from the neck to support the arm or hand.

Sloe. [AS.] A small bitter wild plum, the fruit of the blackthorn (*Prunus spinosa*); also the tree itself.

Sloop. [Du.] A one-masted ship with fore-and-aft sails. The typical sloop has a fixed bowsprit, top-mast, and standing rigging, but those of a cutter can be rapidly shifted.

Slot-machine. An ingenious instrument so arranged that its machinery is set in motion by the weight of a cent, a half-dime or other small coin. Slot-machines in great variety have been made, some adapted to set in action a weighing apparatus, others to drop out small articles, when the coin is dropped in. Among the latest devices is one to give out railroad tickets in exchange for the proper coin, used on the German railroads.

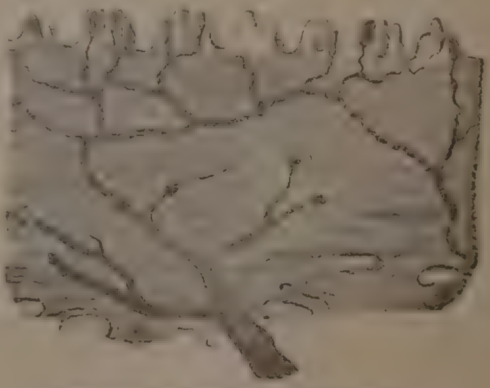
Sloth. [AS.] This is a curious creature without fore teeth and canines. It is a native of Central and South America. Its shape is very different from that of gnawing animals, for its front legs are longer than those behind. Some sloths have three, others two, large strong curved claws to each foot. The two-toed sloths have two toes on the fore foot and three on each hind foot. These the sloth hooks round the branch of a tree, and hanging with its back downward moves with great speed among the thick forests. Its strong coarse hair is so like the color of the trees that it is not easily seen among the branches; and there it has no enemies to fear except men and snakes. The natives of South America hunt it for its flesh, of which they are very fond. On the ground it moves with a slow, awkward shuffle, hooking its strong claws into the ground, and dragging itself along. When attacked it throws itself on its back, and tries to choke its enemy with its powerful arms. It lives on leaves and twigs, and completely strips one tree before it begins to strip another.

Slug. A land-dwelling mollusc, without a shell, except a small internal one which protects the heart. The slugs are the pests of gardens and cultivated places, and give much trouble to gardeners.

Sluice. [Old Fr., from *exclusa*, shut out.] A door or gate, sliding in a frame, for shutting off or regulating the flow of water; also a long box used in washing for gold.

Smelt. [AS.] A small salmonoid fish which ascends rivers to spawn, much esteemed for food. It has a peculiar odor.—*Candle fish* is a kind of smelt found on the North Pacific coast, and is so oily that it may be used as a candle by drawing a wick through it.

Snail. [AS.] A soft slimy land mollusc, usually protected by a spiral shell. Besides long tentacles tipped with black eye-specks, snails have a shorter pair, which are organs of smell. There are over 2,000 species of snails, and they are found in all parts of the world except the Arctic regions. Some are even smaller than a pin-head; while others, in France and Italy, cultivated for food, are fairly large. The Great Vine Snail was considered a table luxury by the ancient Romans. Snails are vegetarians, and have jaws and tongues of saw-like edge, with thousands of rasping points on each. On the approach of cold weather the



S[illegible] OF THE [illegible], MAGNIFIED.

snail throws a film over the mouth of its shell, which tightens like a drum-head. Snails have astonishing vitality. They regain activity after having been frozen in solid blocks of ice, and endure a degree of heat for weeks which daily crisps vegetation. In very dry weather they close up the shell as in cold weather, to retain the bodily moisture.

Snake. [AS. *snaca*, creeper.] A creeping reptile, whose gliding motion is due to having the vertebræ jointed with ball-and-socket joints. On each vertebra is a pair of ribs which are used as legs, working the snake backwards and forwards; and its scales are used as feet, catching the ground and pulling or pushing the whole body. Its jaws are joined by an elastic gristle, so that they can be spread wide; and its tongue darts far out beyond its lips, touching or feeling. Its teeth are not used for chewing but for holding and swallowing its prey. There are the black snake, blind snake, garter snake, green snake, ring snake, rock snake, milk snake, water snake, and dwarf snake, and various venomous snakes, such as the rattlesnake and the copperhead. The python is sometimes 30 feet long, and the female incubates her eggs. (See *Boa*, *Cobra*, *Rattlesnake*, *Serpent*.)—*Snake-bird* or *darter* is a kind of gannet with a snake-like neck.

Snap′ping-tur′tle. The common name of a family of reptiles, comprising turtles with the body high in front, low behind, large head, long neck, powerful jaws, tail long and strong. If assailed they raise themselves on their legs and tail, throw the body forcibly forward, and snap the jaws with great power upon their foe. They are a match for any enemy likely to attack them except man. They are frequently found upon the land near the water, devouring small animals. There are three species, two of which are American. They are hunted for their flesh, which makes a rich and palatable soup.

Snipe. The common name of a large family of birds, found in many parts of the world. The common snipes of Europe and America are much alike in size and plumage, being about 17 inches in total length, of which the bill is nearly 3 inches. They fly very swiftly and in a zigzag manner, and are difficult to shoot, though much hunted as a delicious game bird.

Snow. [AS.] Frozen moisture falling in soft white flakes. It is not produced, like hail, by the freezing of rain-drops, but formed by the direct passage of the vapor into the solid state. It falls to the earth in flakes, each flake consisting of a regularly shaped crystal, or, as more commonly happens, of several crystals grouped together. The most common form is that of six-pointed stars variously modified. Each star has a solid nucleus, from which six little rods of ice proceed at regular angles, and from the sides of these rods secondary rays may be given off, producing a countless variety of very beautiful figures. The snow-flakes are largest when the temperature is near the freezing-point, the snow being then soft and easily gathering into masses. The texture of snow being very loose, it is a bad conductor of heat; and being also a bad radiator on account of its white color, it forms an admirable covering for plants, shielding them from the effects of severe frosts.

Snow-bunting. An American bird, common in summer in the Arctic regions and in winter in the United States. It resembles the lark in its habits, and is generally very fat and much esteemed for the table.

Snow-drop. A small bulbous plant, with white dropping or hanging flowers, often appearing while the snow is on the ground.

SNOW CRYSTALS.

Snow-line. The line on a mountain above which snow never melts. The lowest limit of perpetual snow in the Alps is at 9,000 feet above sea-level, and in the Andes, at the equator, 16,000 feet.

Snow-shoe. A flat shoe worn to keep the foot from sinking in the snow. The frame of wood is three or four feet long and about a foot wide, with thongs or cords stretched across it, and having a support and holder for the foot.

Snuff. [Du.] Tobacco or stalks of tobacco finely powdered taken into the nose. It is scented with essential oils or otherwise. It was formerly much used, but is now very little.

Soap. [AS., akin to L. *sapo*.] A mixture of oil or fat with soda or potash for washing. Since the cheapening of caustic soda by the Le Blanc process, soda is chiefly used instead of potash as the alkali of soap. Common soap is a compound of fat or oils (*q.v.*) and caustic soda. Many kinds of soap are made, but they all consist of some fatty substance (as tallow) boiled with an alkali—either caustic soda or caustic potash. *Yellow soap* is made from tallow and caustic soda colored by rosin; *mottled soap*, from dripping, etc., boiled with caustic soda; *Castile soap*, from olive oil and caustic soda; *brown windsor*, from equal parts of tallow and olive oil boiled with caustic soda; *white* or *curd soap*, from tallow and caustic soda. *Transparent soap*, is made by dissolving curd soap in spirits of wine. *Marine soap*, is made from cocoa-nut oil and caustic soda; it will dissolve in salt water (which common soap will *not* do), and is therefore much used on board ships. *Soft soap* is made by boiling caustic potash with some fish-oil.—*Soapstone*, or *talc*, is a silicate of magnesia used to make stoves, hearths, crayons, etc.

So′da. [Ital.] A substance formerly got from sea-weeds, and in 1791 it was produced from common salt by Le Blanc. In this process salt is transformed into sodium sulphate by adding sulphuric acid; then by mixing with chalk and coal it is made into sodium carbonate. Soda can be produced by electricity from brine. It is the most important of all chemical products used in the industries. *Caustic soda*, or sodium hydroxide, is used in making soap, wood pulp for paper, etc.; *cooking* or *washing soda* is sodium bicarbonate.

So′da-water. Water mixed with a little soda and carbonic acid; a beverage consisting of water highly charged with carbonic acid, to which fruit syrups are usually added.

So′dium. A common metallic element of the alkali group, always found combined, as in common salt. When isolated it is a soft, waxy white metal, so readily oxidized that it combines with water and must be preserved under petroleum. As a means of obtaining magnesium and aluminium, sodium is an important article of commerce. Its compounds are widely diffused in nature, and can be detected by the peculiar yellow color which they impart to a flame, or by the yellow line in the spectrum.

Soil. [Fr., from L. *solum*, ground.] Earth in which plants grow. Soil consists of a mixture of earthy materials resulting from the disintegration of the rocks by natural agencies, and a deposit of organic matter arising from the growth and decay of vegetation on the earth's surface. The influence of earth-worms, ants, and other small creatures on the condition of the soil has lately been shown to be considerable.

So′lan Goose. [Scand., *Sula.*] The gannet (*q.v.*).

So′lar Spec′trum. [L.] The spectrum of solar light, characterized by numerous dark lines, called *Fraunhofer lines*, from being observed by a German physicist of that name. [See *Spectrum.*]

So′lar Sys′tem. [L.] The sun, with the bodies revolving round it, and receiving from it their light and heat, and held by its attraction. It includes eight planets with twenty-two satellites, of which the Earth has one, Mars two, Jupiter five, Saturn nine, Uranus four, and Neptune one. There are more than four hundred asteroids, or very small planetary bodies, known between Mars and Jupiter. The meteoroids furnish the zodiacal light and the rings of Saturn. The year of Mercury is nearly 88 days; of Venus, nearly 225 days; of the Earth, over 365 days; of Mars, nearly 687 days; of Jupiter, nearly 4,333 days; of Saturn, over 10,759 days; of Uranus, nearly 30,687 days; of Neptune, over 60,181 days. The four outer planets are very much larger than the interior ones. There are many comets included within the solar system.

Sol′der. [Fr., from L. *solidus.*] Melted metal used for fastening pieces of metal together. *Hard solder*, for fusing at red heat, is composed of zinc and copper or silver and copper. *Soft solder*, for low temperature, in use among plumbers, consists of two parts lead and one part tin.

Sole. [L.] A kind of flat-fish of the genus *Solea.* The common sole of Europe is much used for food. Lemon or French sole is another species. The megrim is the British smooth sole or scald fish.

Sol′stice. [Fr., from L. *solstitium.*] The point in the ecliptic at which the sun is farthest from the equator, either north or south, and at which it seems to stand still. The 21st of June is the summer, and 21st of December the winter solstice; for some days before and after these dates the length of day is very similar. Both points are 23° 28′ from the equator.

Soot. [AS.] The loose black particles from smoke in chimneys disengaged from the fuel in process of combustion, consisting chiefly of carbon, and the result of imperfect combustion.

Sor′rel. [Fr.] A plant like the dock, whose leaves have a sour taste. *Mountain sorrel* has rounded kidney-formed leaves. *Red sorrel* is found in the West Indies, and the calyxes and capsules are used for making tarts and acid drinks. *Salt of sorrel* is binoxalate of potash, and is obtained from common sorrel or *Rumex acetosa.*

Sound. [Fr., from L. *sonare.*] That which can be heard. In physics, it is applied to the external cause which produces the sensation. In this sense the word *sound* stands either for the vibrations of the sounding body or for the impulses it has communicated to the air, and which immediately affect the ear. It can be shown by experiment that sound is the result of a vibratory movement which when sufficiently rapid produces a sound. A bell, a glass plate, a tuning fork, a piano string, if put into a state of vibration, will produce a sound if the vibrations take place in a suitable medium. It has been found that sound is not transmitted in a vacuum. A bell struck in the exhausted receiver of an air-pump is nearly inaudible. In water, sound travels nearly four times as fast as in air, in which its speed is about 1,093 feet per second. In solids the velocity varies widely. In inelastic substances like lead or wax it is small, while in those like wood and steel it is large. Musical sounds differ from one another in respect to *intensity*, *pitch*, and *character* or *timbre.* The intensity depends upon the amplitude of the vibrations. Pitch is the quality which distinguishes an acute sound from a grave one. It depends upon the frequency of vibration. As with other forms of wave motion, sound may be reflected and refracted; and if not in accord with each other their interference gives rise to beats.

SPINNERET OF SPIDER.

Soup. [Fr.] Water with meat or vegetables boiled in it and used for food. *Soup maigre* is made chiefly from vegetables or fish, with a little butter and a few condiments.

Sov′ereign. [Fr., from L. *supremus.*] A British gold coin worth twenty shillings.

Spade. [AS.] An instrument for digging, having a broad oblong and nearly rectangular flat blade, usually of iron, with a wooden handle.

Span′iels or **Spanish Dogs.** Handsome animals with long silky hair, drooping ears, bushy tails, and feet partly webbed. Water spaniels are good swimmers, and field-spaniels can fetch game. Blenheim and King Charles spaniels are lap-dogs.

Spank′er. [AS.] A fore-and-aft sail on the mizzen-mast attached to a boom and gaff.

Spar′row. [AS.] The Sparrow family is a numerous one of perching birds. They help the farmer by keeping down caterpillars, grubs, and insects, which would otherwise overrun the fruits and crops; but they are very combative and drive other birds away. The white-throated American sparrow has a black crown, yellow spots over the eyes, orange edges on the wings, and a white throat. It is called the peabody bird from the sound of its note. The English sparrow, introduced into the United States to destroy the caterpillars of the tussock moth, which are injurious to shade trees, has greatly multiplied and is the common bird of cities and towns. The hedge sparrow is the size of the robin, and belongs to a different family. Its beak is black and rather long and slender. The solitary sparrow is a species of thrush, and is a native of Southern Europe. It resembles the blackbird, and has bluish feathers. The Sparrow family includes finches, swallows, thrushes, and larks. (See *Beak.*)

Spar′row-hawk. A small hawk which preys on sparrows and other small birds. It is the most pernicious of hawks, feeding on pigeons, partridges and young fowls. It is bluish gray in color, with a cream-colored breast. It builds in hollow trees or in ruins. It is found in large numbers all over the world. It lays four or five eggs of a white color, spotted with red.

Spear. [AS.] A long shaft of wood, with a sharp iron point, used in fighting, hunting, or in catching fish.

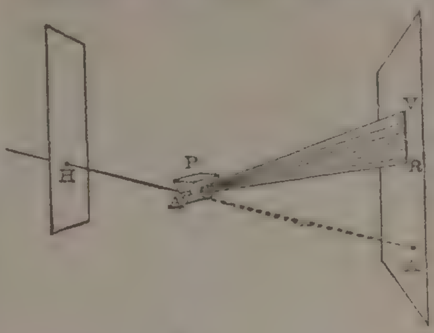
Spear-fish. A large, powerful fish found in the Mediterranean, related to and somewhat like the sword-fish. It has scales and ventral fins.

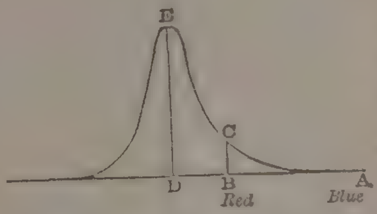
Specif′ic Heat. The quantity of heat required to raise the temperature of a pound of a substance one degree, taking as a unit of measure the freezing point quantity required to raise one pound of water at one degree. The specific heat of mercury is 0.033, that of water being 1.

Spec′tacles. [L.] Two glasses set in a light frame to help weak sight. They were invented by an Italian in the thirteenth century. For short-sighted eyes, spectacles with concave lenses are used, which form an image of the object nearer to the eye than the object itself. For long-sighted eyes, spectacles with convex lenses are used, which form the image at a greater distance from the eye than the object.

Spec′troscope. [L. *spectrum*; and Gk. *skopeo*, I see.] An instrument consisting of a telescope with a prism for separating the rays of light proceeding from the sun and stars or from burning substances, so that, by the relations of the lines to one another, the composition of the substances burned may be ascertained.

Spec′trum. A ray of light separated by a prism or otherwise into the colors of which it is composed. There are seven different bands of color—red, orange, yellow, green, blue, indigo, and violet. The spectrum of solar light or that of the light given off by burning bodies, is found to be crossed by very many dark lines or spaces where the light is interrupted. These are known from their discoverer, as the Fraunhofer lines. If the substance burned is a gas, its lines are bright instead of dark, and the rest of the spectrum is dark. Each substance makes a different set of lines, and *spectrum analysis* is a method of examining the lines in any ray of light and determining by them what substance yields the ray. By this means it has been found that many earthly substances exist in the sun, such as hydrogen, iron, sodium, etc. Similar substances have been found in very distant stars. Many of the nebulæ give a spectrum of bright lines, from which we conclude, that they are composed of luminous gaseous matter.





Spec′ulum. [L.] A piece of polished metal which acts like a mirror, as in a reflecting telescope. Silvered glass mirrors being lighter and more easily made, have taken the place of metallic mirrors.

Spermace′ti. [L. *sperma*, seed; and *cetus*, a whale.] A kind of fat from the head of the sperm whale used in making candles, ointments, and cosmetics. It is a semi-fluid substance which, on being taken from the animal, hardens as it cools. The large head is partly occupied by a cavity containing spermaceti, and other cavities throughout the body are also filled with it. It consists of salts of palmitic acid and ethal and hydrocarbon bases.

Sperm Oil. Oil got from the sperm whale. It is a thin and valuable oil, and, like spermaceti, is used in ointments and medicine. It is slightly pressed from the other matters with which it is mixed, and one animal has been known to yield 6,000 gallons of this oil.

Sperm Whale. A kind of whale called also cachalot, from which sperm oil and spermaceti are obtained. Sperm whales frequent tropical seas and live in groups or shoals. They have large, square heads, with a single blow-hole near the extremity of the snout. They have no whalebone plates in the mouth, but the lower jaw is furnished with large, conical, curved teeth, and when the mouth is closed the teeth fit into cavities in the upper jaw. They sometimes grow to the length of 80 feet.

Sphere. [Fr., from Gk. *sphaira*, a ball.] A round body; also the apparent surface of the heavens, which is assumed to be spherical and everywhere equally distant, in which the heavenly bodies appear to have their places.

Sphinx. A fabulous monster of classic lore, with the head and bust of a woman, the body of a dog, wings of a bird, and tail of a serpent. The Egyptian sphinx was a winged lion with a human head and bust. This creature was carved in stone, and set up in rows as approaches to the great temples. The Great Sphinx, near the Pyramids of Egypt, is 62 feet high.

Spice. [Fr., from L. *species.*] A vegetable production, with a strong, sweet smell and sharp taste, used as a seasoning by mixing with food. The chief spices are ginger, cinnamon, nutmegs, cloves, allspice, and pepper (*q.v.*). Allspice or pimento is a native of Jamaica, and is an evergreen tree. The berries are dried and much used for flavoring, as they contain the flavor of other spices.

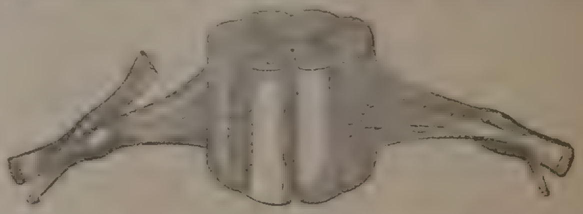
Spic′ules. Needle-shaped objects in sponges, which retain the shape of the sponge when the flesh is removed. Flints (*q.v.*) are filled with fossil spicules.

Spi′der. [AS., from *spin.*] An animal allied to the insects, which spins a web in order to catch flies for food. There are two divisions in the spider's body. The upper, or head part has a horny covering, and is united to the abdomen by a short stalk. Spiders have four pairs of legs, ending in hooks. Near the mouth are hooked teeth which have slits at the ends from which a poisonous fluid is ejected. There are eight eyes on the back of the head. Some spiders spin no web, but jump upon their prey; others, as the tarantula, run it down; but most snare their prey by traps in the form of exquisite webs. The webs of the house spider and cellar spider are woven in many shapes, but the garden spider weaves a geometrical web. At the end of the abdomen of the spider are from four to six spinnerets covered with tiny points, from each of which flows a gummy fluid which hardens into silk when it reaches the air. A web is fastened to an object by simply touching the spinneret with the object. Having arranged the long rays or spokes, a spiral thread is run round and round. Then a silken den to hide in is built near by, with one long thread by which she can feel if a fly strikes the net. Nearly all spiders enclose their eggs in a cocoon, which sometimes the mother carries on her back. Gossamer spiders send out long floating lines which carry them through the air. The water spider makes a bell-shaped cell under the water, and takes down a little bubble of air into the bell to supply it with air. The trap-door spider lives in warm countries, and has a nest in the ground lined with silk and covered with a lid made by layers of earth and alternate webs fixed to the nest to make a hinge. From the gossamer web of the garden spider are taken the fine threads which are stretched across the lens in the astronomical telescope for accurate sighting.

Spike. [L. *spica*, an ear of corn.] A piece of pointed iron or an ear of corn.—*Oil of spike* is a colorless or yellowish aromatic oil from broad-leaved lavender, used as varnish and as medicine.

Spin′ach. [Ital. from L. *spina*, a thorn, or *Hispania.*] A vegetable used for food, some varieties having thorny or prickly leaves, belonging to the Goosefoot family, grown in almost every country. It is (also) called *Spinage.*

Spi′nal Cord. A long, round mass of nervous matter situated in the cavity of the spinal column. The brain is a soft mass of gray and white nerve-matter, about three pounds in weight, which fills the interior of the skull. From it a cord of nerve substance, about as thick as the little finger, and some eighteen inches in length, passes downwards from the brain along the centre of the backbone. This is called the spinal cord. Long but very fine nerves extend from the brain and the spinal cord to all parts of the body.



Spinning. [AS.] Drawing out and twisting fibres into threads. Long threads are spun by *mule* spinning-machines, which carry hundreds of spindles. The spindles are set and run swiftly in one long straight row on a wheeled frame, which backs off and returns with them all at once. Ring-spinning or warp-spinning is twisting the thread used for warp. As it is spun, it is wound on small bobbins and rewound on larger bobbins or spools, and then wound on large rollers the same width as the cloth to be made. It is then starched and dried before weaving into cloth.

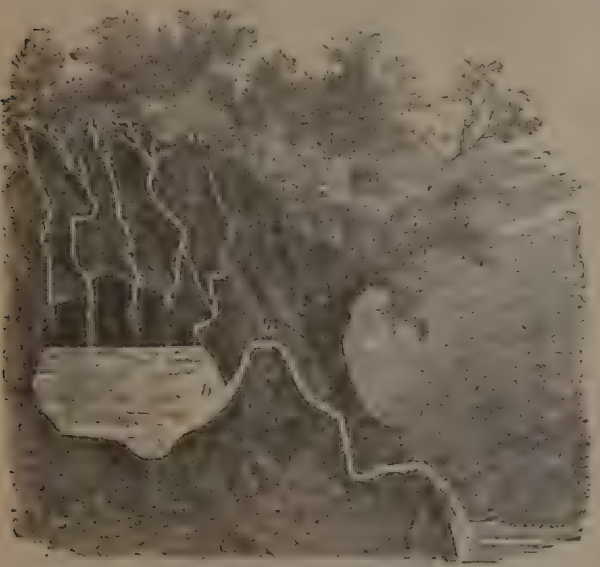
Spitz Dog. A breed having erect ears and long silky hair, and called also Pomeranian.

Sponge. [Fr., from the Gk.] The animal occupying the lowest rank among the many celled animals, and next above the Protozoa, or single-celled animals. It consists of a network of horny or fibrous substance, or of lime or silica. This is covered and filled with a slimy flesh, through which run numbers of tubular passages. The sponge remains in the place to which it is attached under water, drawing in water and letting it out again, and feeding on the particles in the water. Coarse sponges are fished up with harpoons. Men dive for the fine sponges, and cut them off with knives, and the skeletons washed of their slimy flesh and dried are the sponges of commerce. The large bath-sponges come from the Mediterranean and the Bahamas. The zimocca comes from the Mediterranean. The yellow hard-head sponge is found in American waters on the Florida coast. It is dense, thick, and hard. The finest, softest, and most delicate sponge is the Turkish toilet sponge, from the Red Sea, the Indian Ocean, and the Grecian Archipelago. Sponges are of all shapes and colors—like a vase, trumpet, globe, or branch of a tree. Neptune's cup is a curiously-shaped sponge. Venus's flower-basket is made of glassy threads. Sponges are useful for the bath, are made into a kind of cloth as a foundation of carpets and rugs, and are sometimes used to stuff cushions.

Spoon′bill. A long-legged wading bird akin to the heron, having a bill like a spoon. Its bill is wide and flattened at the tip, and it scoops up its prey. Like the heron it fishes, and like the duck it searches for worms in the mud. Its color in the first year is a dark chestnut, the second year it changes to red, and the third year to bright scarlet. The royal spoonbill of Australia is white, and the male has a crest.

Sprat. [Du.] A small fish somewhat like young herring or the pilchard. The sprat is marked by a deeply-serrated abdomen, while the young herring is without this. Sometimes called a garvie. (See *Whitebait.*)

Spring. [AS.] An outflow of water from the ground. The water of springs consists of rainwater which has soaked into the ground and percolated through the rocks, sometimes for a distance of several miles. Water easily passes through porous rocks, such as sandstone, but it cannot pass through clay. It then travels along the junction of two strata for a greater or less distance until it finds its way to an outlet and reappears at the surface as a spring. Springs of this simple character are very common, and are known as *surface springs.* *An Intermittent Spring* is one that flows and stops alternately being connected with a reservoir (*b*) by a sutured siphon (*a*). *Mineral springs* have mineral ingredients, which they hold in solution.



INTERMITTENT SPRING

Spring′bok. [Du.] A South African gazelle, noted for its swiftness, springing action, and graceful form. It has a white stripe on the back and tail.

Spring-tide. The highest tide at or soon after new and full moon. It rises higher than the average tide. (See *Tides.*)

Spruce fir. [From *Prussia.*] A kind of fir, but unlike firs in having pendent cones with persistent scales and leaves arranged round the shoots. The sprouts are used to flavor spruce beer and the wood is used for fences, boat building, cooperage, etc. There are many varieties in Norway and the north-west of America. Frequently seen in parks.

SQIRREL.

Square. [Fr., from Ital.] Having four equal sides and four right angles. In *carpentry*, the square has at least one right angle and two or more straight edges. It includes a carpenter's square, L, a T square, and a try square ⊿.

Squash. The fruit of a species of the gourd plant, to which the pumpkin and melon also belong. It was grown in America by the Indians before the whites came; also in Europe in early times. It is smaller than the pumpkin, the chief kinds being the round flat ones with scalloped edges and the long crook-necks. An English variety is the vegetable marrow or egg-squash. It is much used in New England in pies, and is a common table vegetable throughout the United States.

Squid. Any one of numerous species of cephalopods with ten arms, a long, tapering body, and a caudal fin on each side. The squid is abundant in the North Atlantic, and is used as bait in codfishing. It is also known as calamary, and has a sac of ink-like fluid, which it discharges from a siphon tube to hide it from its foes. (See *Sepia.*)

Squir′rel. [Low L., from Gk.] A beautiful little gnawing animal, of different colors and sizes, found in all parts of the world except Australia. The tail is not only the squirrel's greatest ornament, but is of the utmost use to it in leaping. The hairs stretch out on both sides like a fan, and serve to guide the animal. The flying-squirrel is so called from its having a skin, as thin as paper, but covered with fur, stretching between the front and hind legs, which makes a kind of wing, with which it can jump from tree to tree. It is found in Java, India, America, and Siberia. The common red squirrel lives among trees, building a round nest at the top of a very high tree. It eats nuts, acorns, and corn, and lays up a store of food for use in winter and spring. Its hind legs are longer than its front ones between which it holds its food. The chipmunk or ground squirrel is so called because, though it can climb trees very well, it does not live in them, but makes its nest in burrows deep under the ground. It has large cheek-pouches, in which it carries its food to its underground store-houses. It is a beautiful striped animal, and is common in North America, where it is also called the chipping squirrel.

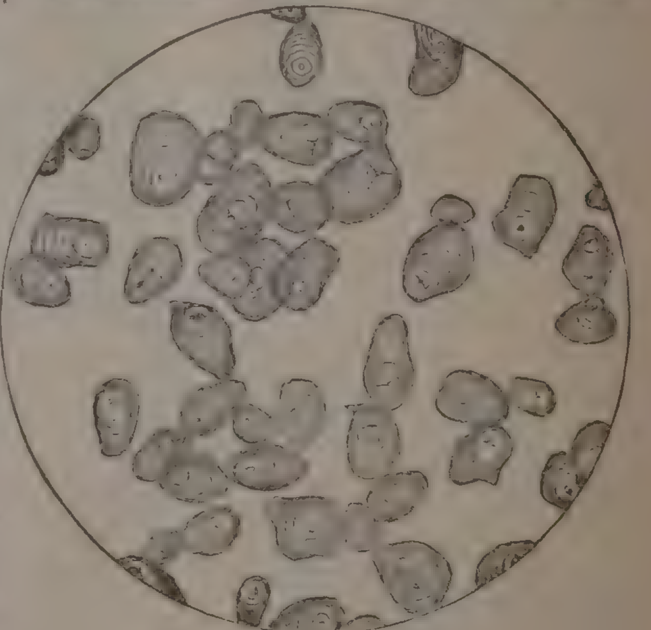
Stag. [Scand.] The male of the red deer of Europe. Its horns are long and branching, and when of full growth will often weigh twenty-four pounds. When the horns carry twelve points or tines the stag is a *royal* one. There are antlers in existence with many more points than this, one in Saxony having 66 points.

Stalac'tite. [Gk., to drop.] A stalk of lime hanging from a limestone cave. It is due to water carrying lime which makes its way through the cave roof, and evaporates, leaving the lime hanging like an icicle. *Stalagmite* is the stalk of lime on the floor of the cave which has dropped in water from the roof.

Sta'men. [L., a thread.] One of the thread-like pollen-bearing stalks in the centre of a flower.

Star. [AS.] One of the bright bodies seen in the sky at night, whose distance is so great that as seen from the earth they appear only as points of light. By astronomers the stars are looked upon as the suns of remote systems. Like our sun, they emit light; and when the spectroscope is applied to the light which they give out, it is found that the materials of which the stars are composed agree with those known to be present in the sun and in our earth. The distance of the stars is so great that when viewed from the earth they are always seen in the same direction; hence, as they maintain an invariable position relative to each other, they have been named *fixed stars*. This term is used in a comparative and not an absolute sense, as it is known that many of them are in a state of motion, although it can be perceived only by delicate observations. They are divided into classes, according to their apparent brightness. These are termed magnitudes. The brightest stars are said to be of the first magnitude, those that fall short of this of the second, and so on. Down to the sixth or seventh magnitude the stars are visible to the naked eye, and from the eighth to the sixteenth by powerful telescopes. The three or four brightest classes are distributed with tolerable uniformity over the celestial sphere; but of the total amount visible to the naked eye and by means of the telescope, by far the larger number are in or near the Milky Way. In certain parts of the heavens the stars are collected into groups in a more condensed manner than in neighboring parts. Such groups are called *clusters*. One well-known group is called the Pleiades, in which six or seven stars may be noticed by the naked eye, but which photography has shown to consist of 2,326. Many nebulæ that were formerly thought to be masses of glowing gas have been recently found to be clusters of stars so remote that their individual members are imperceptible except with instruments of great power. Photography has revealed stars so far distant that a message sent 1,900 years ago would only have just reached them, and would be still on the way to others, going with the speed of light, or 186,000 miles a second.

Starch. [AS.] One of the main constituents of plants. It is composed of carbon, oxygen, and hydrogen, the last two in the proportions required to form water. It is near to sugar in chemical composition and is converted into it in the life history of the plant. Wood fibre belongs to the same class of compounds. These make up the great bulk of the plant, the remainder being its oily matter and its nitrogenous substance, which forms the protoplasm of its cells. Starch for commercial use is chiefly obtained from wheat, maize, rice, and potatoes; and in France from horse chestnuts. Starch in maize is from 60 to 80 per cent.; wheat, 66; rye, 60; oats, 46; barley, 57; rice, 61; potatoes, 61. Starch is found in the form of little grains contained in the cells of plants. It is insoluble in cold water; but in hot water the grains swell up until they burst and form a jelly-like mass. Corn starch is made in the United States by soaking Indian corn in water containing caustic soda and hydrochloric acid to dissolve the gluten, grinding, washing on sieves, and finishing by various processes. Rice starch is largely made in England, France, and Belgium. Starch is useful for stiffening cloths, sizing paper, making paste, dextrine, glucose, detecting iodine, and as an article of food. (See *Rice*, *Sago*.)



POTATO STARCH CORPUSCLES.

Star-fish. A star-shaped sea animal which creeps over rocks and sand, feeding on mussels and shell-fish. The five rays are made of limestone plates, joined by a tough membrane. Under each ray is a groove with hundreds of tiny transparent tubes moving separately. The tubes act as feet and carry the animal forward. When the star-fish feeds, it not only bends its rays into a cup shape to hold its prey, but numerous tiny suckers spring up to help. Star-fishes have a liver and intestines, and these organs extend into the five rays. They have nerves which end in a red eye-speck at the end of each ray. They do great damage to oyster beds, as they eat the oysters, which they force to open their shells. They are dredged from the beds and used as manure.

Star′ling. [AS.] A small greenish-black British song-bird, which can be taught to whistle tunes and sometimes to speak a few words. It builds in church steeples, in ruins, or on rocks. The food of the starling consists of insects, caterpillars, worms, and snails; but it also feeds on grain, fruits, and seeds. In severe winters it frequents the sea-shore, but in summer it is found in the farmers' garden, where it makes harsh cries and chattering sounds before retiring to rest. In America, bobolinks, cow-birds, meadow-larks, orioles, and red-winged blackbirds are all starlings. The bobolink is black and white. The oriole is called a hanging bird because of its peculiar nest, which is like a pouch or pocket.

Steam. [AS.] Water in the gaseous state. The clouds of vapor which are seen to issue from a kettle of boiling water are also popularly called "steam;" but these white clouds consist chiefly of condensed steam, and do not possess the properties which belong to steam considered as a gas. Dry steam is as much invisible as atmospheric air. Owing to the great pressure which it exerts, to the large amount of heat which it can carry, and to the ease with which it can be condensed, steam has been found better fitted than any other gas for use in engines employed for the production of mechanical work.

Steam-engine. An engine worked by steam. The chief parts are the piston, cylinder, and valve gear. The piston works in a cylinder, to which steam is admitted by the action of the valve gear, causing the piston to move backward and forward and communicate motion to the machinery. The atmospheric engine constructed by Newcomen near the beginning of the eighteenth century was the first in which a beam was made to oscillate by the elastic force of steam. It was used for pumping water out of mines. The condensation of the steam in the space below the piston produced a vacuum, and the piston was forced down by the pressure of the atmosphere. One of Watt's first improvements was the introduction of a separate chamber for the condensation of the steam. Another improvement introduced by Watt was *double action*. By this arrangement the steam was introduced alternately above and below the piston. This consisted in cutting off the steam from the boiler before the piston had reached the top of the cylinder. It need scarcely be said that many later improvements have been introduced in the steam-engine, greatly increasing its powers.

Steam-turbine. A new form of steam motor, in which the steam is thrown against the valves of a turbine-wheel, which it causes to turn with great rapidity. These machines develop great power in small space. They have been placed in torpedo boats, driving them through the water at the unequaled speed of over 35 knots an hour.

Ste′arin. [Gk. *stear*, tallow.] A constituent of animal fats, as beef and mutton suet; and some vegetable fats as of cocoa. It is remarkable for its solidity, and raises the melting-point of fat. It is prepared by mixing ether with suet, and is used in making soap.

Steel. [AS.] A hard metal made by heating iron with charcoal. Steel is the form of iron in which the amount of carbon is intermediate between that contained in cast iron and in wrought iron. In steel, the carbon is either chemically united with the metal or dissolved in it. It may contain silicon and manganese in small quantities, but sulphur or phosphorus is regarded as an impurity. It is malleable and ductile, fusible, and capable of acquiring, by being tempered, great hardness, which renders it suitable for cutlery and the different varieties of cutting tools. Steel was at one time always prepared from wrought iron by heating the bars for some time in contact with charcoal. This method of preparation is known as *cementation*. The process of manufacturing steel known as the Bessemer or pneumatic process is of very great industrial importance. It consists in blowing air through molten pig iron in a vessel called the converter. The carbon and the silicon which the pig iron contains are thus oxidized, and the iron is brought to the condition of wrought iron. After the iron is completely deprived of carbon, a certain quantity of pure cast iron is added in order to supply the carbon necessary to convert it into steel. The metal is then cast into ingots. This kind of steel is used for railway axles and rails, for boiler plates, and for ships. Large buildings, as churches, colleges, and schools, are now made with frame-work of steel. The walls are double, and the air between acts as a non-conductor of heat.

Sten′cil. A thin plate of metal or other material with letters or a pattern cut through it. It is laid flat on a surface, a brush dipped in paint or ink rubbed over it, and the letters or pattern thus transferred. Stencils are much used by merchants to mark boxes or barrels.

Steppe. The vast, low plains of Europe and Asia, extending from Holland to Russia and thence through Siberia and Mongolia. The name is specially applied to the broad and largely arid pasture lands north and east of the Caspian, and the Siberian lowlands.

Ste′reoscope. [Gk.] An optical instrument of magnifying-glasses, with a slide for two slightly different pictures of the same thing, which when looked through throws both pictures into one, and gives the figures the appearance of solidity.

Ste′reotype. [Gk.] A metal plate, being an exact copy in a solid form of a page of type. Stereotyping by plaster of Paris was discovered by Ged in the eighteenth century. Electrotypes have now taken the place of stereotypes in bookwork. In newspaper offices, where speed is important, the paper process of stereotyping is still much used. In this process the type is placed under a press, and a matrix is made of damp paper by forcing the type into the paper. After the paper is dry type-metal is poured over it, and the metal plates are trimmed and planed.

Steth′oscope. [Gk.] A medical tube used for listening to the beating of the heart or the sound of the lungs in breathing.

Stick′leback. [AS.] A very small fish with two or more prickles on its back. It builds a nest somewhat like that of a bird. The male gathers weeds and erects a barrel-shaped house. He secretes in his body a sticky slime, which as soon as it touches water grows firm and hard, and with this he cements the nest. There is a hole right through the nest, so that the water flows over the eggs. In times of danger the father opens his mouth, and the whole swarm of young fishes rush in for protection. Sticklebacks inhabit both salt and brackish water.

Sting. [AS.] The sharp point with which bees, wasps, etc., defend themselves. The sting of a female bee is a dart with barbs at the end of the abdomen connected with a poison gland; and the sting is sometimes used in different bees for boring, cutting, and sawing holes in which to place the eggs. Male bees have no stings, and are harmless. When the bee leaves the sting in the wound it dies. The wasp saves her sting after inflicting a wound. The sting-ray has one or more large sharp barbed dorsal spines on its whip-like tail. The stings of nettles are hairs with a poisonous secretion.

Stone. [AS.] A piece of rock, or the hard centre of fleshy fruits. *Building stones* are natural or artificial. Natural stones are chiefly granite, marble, limestones, sandstones, and also slates. The hard stones are generally got by blasting, others by channeling and wedging, while the more fragile are sawn out in the quarries. Large masses of stone are called *rock*, smaller pieces *stone*, and finer pieces *gravel*, or still finer *grains of sand*. *Precious stones* include diamonds (*q.v.*), emeralds and beryls, sapphires (*q. v.*), and rubies (*q. v.*), amethysts, serpentine, malachite (*q. v.*), turquoise, jasper, jade, and chalcedony.

Stone-age. The era of primitive man, when his only tools and weapons were made of stone. In the *old stone-age* rudely chipped stone implements were used; in the *new stone-age* the implements were smoothed and polished. Great numbers of these stone utensils have been found, in all parts of the earth. The stone-age was followed by the bronze-age, and that by the iron-age.

Stone′ware. A coarse stuff used by potters, and the vessels of it glazed and baked.

Stork. [AS.] A wading bird of the family Ciconidæ, nearly allied to the heron, with long slender legs and rather thick neck. The bill is as long as the head, and tapers to a point. In Holland, storks give up their aquatic habits and nest on tall trees, towers, or chimneys. Sometimes frames or false chimneys are made on the tops of houses for storks to build on. The nest is built of sticks and dry grass, and there are three or four bluish-white eggs, which take thirty days to hatch. The storks feed on garbage, snakes, frogs, rats, mice, and vermin. In winter they migrate to warmer regions. Before starting on their flight they assemble in large flocks of two or three thousand, and the common belief is that they consult as to their journey. When they return to Holland in spring, they are welcomed as harbingers of that season. The white stork is found in Europe; the black stork in Europe, Asia, and Africa; the black-necked stork is the East Indian jabiru.

Stove. [Du.] A kind of box, generally made of iron, which stands in some part of the room, supplied with fuel from time to time through a door. Stoves are more economical than grates, since less of the heat produced goes up the chimney, but they are not so healthful. Anthracite requires a stove with a base burner, that causes a smaller draft of air, much in use in the United States. Oil and gas stoves are much in use for heating, and gas stoves are coming into large use for cooking purposes.

Straw. [AS.] The stalks or stems of wheat, rye, and other cereal grasses, after the grain has been thrashed. It is woven into hats, and made into boards and paper. Chip hats are not made out of straw, but from splints of Lombardy poplar.

Straw′berry. A widely cultivated perennial plant, having a red, small berry, with delicious taste. In cultivation its runners spread along the ground. The flowers have five petals, and are mostly white, seated on a convex receptacle, which enlarges in the fruiting season, and becomes pulpy and edible; so that what is popularly called the fruit is only the end of the flower stem greatly altered, and bearing the real fruit in the ripened ovaries over its surface, or sunk in the succulent mass. There are many varieties. *Fragaria vesca* is the European kind, and *Fragaria Virginica* the American. The fruit has been enormously increased in size by cultivation.

Strych′nine. [L., from Gk. *strychnos*, nightshade.] A strong poison got from the seeds of nux vomica. It is obtained as a white crystalline substance, and has a bitter, acrid taste. It is insoluble in water, but dissolves in alcohol. In medicine it is used as a stimulant for the nerves.

Stuc′co. [Ital., from a Ger. root of *stück*, a piece.] A kind of plaster made of lime, sand, and finely-crushed marble, for ornamenting walls.

Stur′geon. [Old Fr.] A long, narrow fresh-water fish, the roe of which is made into caviare, and the air-bladder into isinglass. It has free gills, and its body is more or less covered with bony plates, in five longitudinal rows. The tail is heterocercal, having the vertebræ continued into the upper lobe, which is longer than the lower one, and the skeleton cartilaginous. It runs up rivers to spawn. The eggs sometimes make up nearly one-third of the fish, and there are over three million in one female. Sturgeons are found in Europe and America, and in one season 200 tons of caviare have been made on the Caspian. It is now made largely on the Delaware.

Suck′er. A fish of the carp family, many kinds of which are found in the rivers and lakes of the United States. It has no teeth, its lips being formed for sucking. It is found in the rivers in early spring, and is caught in dip-nets. The *buffalo sucker* of the Mississippi is sometimes more than a yard long.

Sug′ar. [Fr. from Arab.] The sweet juice of the sugar-cane and other plants pressed out and dried. It is soluble in water, generally crystallizable, neutral to vegetable colors, and is an organic chemical compound of carbon, hydrogen and oxygen. There are two distinct sugars—saccharoses or sucroses, and glucoses (*q. v.*) or amyloids. The saccharoses include cane-sugar, beet, palm, sorghum, and maple sugar. The first two yield nearly the whole sugar-crop of the world. The cane-sugar comes from the tropics, that of the beetroot from the north temperate zone, very largely from Germany. After sugar is boiled and strained and purified by adding lime, and filtering through cotton and charcoal, it is poured into molds, and when cool forms loaf-sugar. The liquid which remains after the sugar crystallizes, is called molasses, it being a dark, sweet, sticky liquid, much used in cooking. Glucose or grape-sugar is made from starch by the action of heat and acids. Much of it is produced from maize, being largely sold as the glucose sirup.

Sul′phur. [L.] A yellow mineral, occurring in large quantities either as pyrites (sulphides), gypsum (sulphates), or native, mixed with gypsum. It is found in volcanic regions. It is purified by distillation, and is obtained by sublimation as a lemon-yellow powder (flowers of sulphur) or as sticks (brimstone). It burns with a blue flame and a peculiar irritating odor. It is used in gunpowder, and in making matches, in medicine, and in making sulphuric acid. Sulphur is also obtained as crystals.—*Sulphuric acid*, the most important compound of sulphur and oxygen, is a heavy, corrosive oily liquid, colorless when pure, but usually of a brownish color. It is used in the manufacture of hydrochloric and nitric acids, alizarin, soda, and bleaching-powders; in making ether, parchment, and nitro-glycerine, and in etching iron. It was formerly called vitriolic acid, and is popularly called *vitriol* or oil of vitriol. (See *Epsom Salts.*)

Su′mach. A genus of small trees and shrubs, having numerous species, found in all parts of the world except Australia and the polar regions. The leaves of a kind grown in America are used by the Indians for tobacco. The seeds of another kind yield Japan wax or varnish. Chinese galls come from another species, and are largely used in tanning and dyeing. There are twelve kinds in the United States, and two of them are poisonous. These are the poison ivy and the swamp sumach, which cause a skin eruption, attended with violent itching. The Virginian or stag's-horn sumach is a common American species. The leaves are pinnate, the flowers in a crowded panicle, and the fruit globular, covered with hairs. Their scarlet leaves in autumn are conspicuous forest ornaments in America.

Sun. [AS.] The body in the heavens that gives light and heat, and round which the earth and planets revolve. (See *Solar System.*) It is about 92½ million miles distant from the earth, and its diameter is about 860,000 miles. It revolves on its own axis once in 25½ days. Its luminous surface is called the photosphere, above which is an envelope largely of hydrogen, called the chromosphere, visible through the spectroscope, or at the time of a total solar eclipse. Above the chromosphere, and extending for millions of miles, are rays of light called the corona. Dark spots appear on the sun's disc, and consist commonly of a black central portion with a surrounding border of lighter shade. These change in their size from points to spaces 50,000 miles in diameter. It has been established that a maximum and a minimum number of sun spots occur in periods of 11 years. The sun is not a fixed body, round which the earth and other planets circulate, but it, with all the planets, has a motion through space. In regard to *physical structure*, the sun is believed to be a mass of incandescent (glowing hot) gases, the temperature of which is so high that none of the chemical elements entering into its composition can exist in any other than the gaseous state. The quantity of heat given off by the sun is enormous. There are several theories as to its origin, the most probable being that it is due to a gradual shrinkage of the sun's mass which reduces its power of containing heat.

Sun-dial. An apparatus in common use as a time-keeper when clocks and watches were scarce and costly. It consisted of an upright style whose shadow was thrown by the sun on a plate of metal. As the day went on the shadow moved over the marks on the dial, indicating the hours and their divisions.

Sun-fish. A genus of fishes with short, rounded, and flattened bodies. There are small species in many streams, and the great sunfish of the Atlantic grows to the length of 4 feet and the weight of over 500 pounds.

Sunflower. A tall plant, a native of America, having large marginal ray flowers with yellow rings. The seeds are used as food for cattle and poultry, and yield an excellent oil. The flowers abound in honey, and the leaves are useful as fodder. One of the tuberous species is the Jerusalem artichoke.

Swal′low. [AS.] A small bird, with small legs and weak feet, but with long, pointed wings and a forked tail, which are both favorable to swift flying. It flies at a rate of from 60 to 90 miles an hour, and delights in circling round places where insects abound, upon which it feeds. The house-martin or town swallow fixes its mud nest under the eaves of houses. The sand-martin with its tiny beak bores holes in sandstone rocks, where it makes its nest at the farthest extremity with loose hay and a few goose feathers. There are a number of American species, a common one being the barn-swallow. The nest of the esculent swallow, which inhabits Ceylon and Sumatra, is much valued by the Chinese. It consists of seaweed, which the birds swallow and mix with their saliva, and then deposit in layers round their nests, and the whole is hardened by the air. The nests are glued on rocks or inside caverns, near the sea-shore. When boiled, these nests, which are in reality a fine gelatine, yield a good quality of glue or jelly, which is made into soup. (See *Swift.*)

Swan. [AS.] The largest and most graceful of all swimming birds. When full-grown its feathers are white, but when young they are bluish-gray. Its feathers are thick and oily, and cast off water. Its feet are webbed, and it swims rapidly. Its legs are placed far back, and this gives it a waddling walk. Its neck is longer than its legs, and so it can reach its food. It feeds on roots and seeds of water-plants, and is fond of worms, small fishes, and snails. Its nest is built of grass and reeds on the banks of rivers or lakes. The swan is found all over the world, and being beautiful on the water, is when tame kept on ponds and ornamental waters. The black swan of Australia has a red bill crossed with a white band. The South American black-necked swan has a bright rose-colored double knob on its bill.

Sweet-bread. Part of the inside of an animal, with a sweet taste and a likeness to bread, used as food. The thymus gland is called neck or throat sweet-bread, and the pancreas the belly sweet-bread.

Sweet Flag. A kind of reed which flourishes along the banks of rivers or grows in swamps and ponds. It is found in the cooler sections of Europe and North America, also in some parts of Asia. Confectioners use its roots, which have a strong smell and a biting taste, in making some kinds of candy.

Sweet-pea. An annual plant, *Lathyrus odoratus*, or its many-colored sweet-scented blossoms.

Sweet-potato. A plant which is not allied to the white potato, but belongs to the morning-glory family. It is a creeping vine, bearing long root tubers of sweet taste. It was probably of American origin, but is now widely cultivated. Many tropical varieties are known as yams. It needs a warmer climate than the Irish potato, and does not do well in Europe, but is widely grown in the United States, many millions of bushels being raised annually.

Sweet-will′iam. A kind of pink of many different colors and varieties.

Swift. [AS.] A quickly-flying bird of the Swallow family. Its form and habits resemble those of the swallow. It has a shorter bill, but it has no complex vocal muscles. It nests in church steeples and under the tiles of roofs, and screams shrilly. The Australian and American swifts have rigid tips to the tail feathers. The American chimney-swallow is a swift which has acquired the habit of building in chimneys, fastening its nest, which is made of small twigs, to the wall by a strongly adhesive secretion. This glue is spread over the whole nest, and becomes very hard.

Sword-fish. A large fish with the upper jaw long and pointed like a sword, which pierces four or five inches of solid wood. Its dorsal fin is high, and ventral fins are absent. It swims very fast, and is one of the deadliest enemies of the whale, which protects itself by diving to the bottom of the sea, whither the sword-fish cannot follow. It is plentiful on the coasts of Massachusetts, where it is caught by the harpoon, and its flesh, though coarse, is eaten.

Syc′amore. [Gk.] A kind of fig-tree in Egypt and Syria; the great maple in Europe and the plane tree in America.

Syr′inge. [Gk.] A tube fitted with a piston for sucking up and squirting out water and other liquids, used for injecting them into wounds or openings of the animal body, or in gardens for throwing liquids upon plants.

T

Tack. [Celt.] A small nail with a broad, flat head; also the direction of a ship in regard to the trim of her sails—the starboard tack when close hauled with the wind on her starboard side, the port tack when on the port side. In tacking or changing the direction, a vessel is brought to point at first directly to windward, and then so that the wind will blow against the other side.

Tack′le. [Scand.] Ropes and pulleys for lifting weights. *Ground-tackle* are anchors, cables, etc.; *gun-tackle*, the apparatus for hoisting cannon.

Tad′pole. A frog (*q. v.*) in its youngest state. In this stage it breathes by means of external or internal gills, and has a fin-like tail.

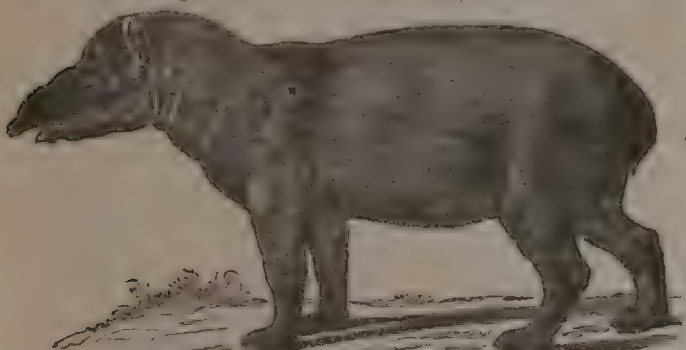
Tail. [AS.] The long flexible part of an animal that terminates its body behind. It contains a series of movable vertebræ, and is covered with flesh and hairs or scales. The tail of birds consists of fused vertebræ; the tail of fishes ends in a caudal fin. Woodpeckers climb and rest on the stems of trees with their tail feathers.

Tail′or-bird. An Asiatic or East Indian bird that makes its nest by sewing together the leaves of trees, and in doing so uses its beak and claws instead of a needle.

Tal′low. [AS. or Scand. *talg.*] The fat of animals of the ox or sheep kind. Its solidity is due to the large amount of stearin it contains. It is used to make candles (*q. v.*).—The *Tallow-tree* grows in China, and produces from its seeds a substance resembling tallow.

Tam′arind. [Arab.] A lofty, wide-spreading tree in the Indies, with flowers in racemes, pinnate leaves, and pods abounding in acid pulp of cooling and laxative qualities. West Indian tamarinds are preserved in sirup, but East Indian fruits are put up without sirup.

Tam′arisk. [L. *tamariscus.*] A tree or shrub with small scale-like leaves and clusters of white or pink flowers. Its bark is used as an astringent, and the ashes of the plant yield sulphate of soda.



TAPIR.

Tam′bourine. A musical instrument consisting of a piece of parchment stretched on the top of a hoop, furnished with little bells. In play it is struck by the hand or elbow, and the bells jingled.

Tan′ager. A group of American birds conspicuous for their brilliant colors. They represent the finches of Europe and Asia. The most beautiful of them, the scarlet tanager, comes from Mexico to the United States in April, its range extending to Canada. The male is of a bright scarlet.

Tandem. A Latin word meaning at length. Applied to horses driven one in front of the other. A bicycle carrying two, three or four persons.

Tan′nic A′cid. Acid derived from *tannin*, which is the astringent principle of oak-bark or gall-nuts, and is used in tanning and as an astringent. It is the basis of common ink. It is sometimes used to describe all astringent substances in the vegetable kingdom—in willow, tea, coffee, etc.

Tan′ning. [Fr. *tanner*, from Armorican *tann*, oak-bark.] The turning of skins into leather (*q. v.*) by steeping in water mixed with oak-bark.

Tape. [AS., from L. *tapete*, cloth for hangings.] A narrow woven band used for tying and binding.—*Tape-worm*, a long, flat, parasitical worm, with small head, no mouth, but having suckers and sometimes hooks for adhesion to the walls of the intestines. The pork thread-worm from pigs, the beef tape-worm from young cattle, and the broad tape-worm are parasites of man.

Tap′estry. [Fr. *tapisserie.*] Cloth of wool and silk, covered with woven or sewed figures, for hanging on walls. Tapestry carpet resembles Brussels carpet in having the colors of the warp printed before weaving.

Tapio′ca. [Braz.] A granular substance got by heating the manioc root. The manioc or cassava root is bitter, and has a poisonous sap, which by grating, pressing, and baking is lost. It is grown in the West Indies and in Africa. Tapioca is much used in puddings and as a thickening for soups.

Ta′pir. [Braz.] An animal with a thick skin, short ears, short neck, and long prehensile upper lip. It is between three and four feet high and from five to six feet long, and in general form reminds us of the hog. The tapir has three toes on the hind feet and four toes on the fore feet, but the outermost toe is of very little use. Its long nose is like a rudiment of the elephant's trunk. There are two kinds of tapirs: one, a native of South America, is of a dusky-brown color; the other lives in Sumatra and Java, and is black, with a broad white band across the body. Tapirs are harmless, gentle creatures, but they can give a severe bite with their big teeth when attacked. They have great strength and can force their way through the thick underwood of tropical forests to the water, of which they are very fond.

Tar. [AS.] A black, sticky liquid, distilled from pine trees and from coal. When charcoal is produced, an arrangement is made for collecting tar. From wood-tar is distilled wood-vinegar or pyroligneau acid, from which is produced wood-naphtha. Wood-tar is got from the Scotch fir, the Siberian larch, and other fir-tree roots. Coal-tar is a product in making gas, and yields crude naphtha and pitch. Mixed with wood-naphtha, crude naphtha is a solvent of resins. Benzole, carbolic acid, and aniline colors are all obtained from coal-tar. (See *Coal-tar.*)

Taran′tula. A poisonous spider found near Tarentum, in South Italy; others are found in Texas. (See *Spider.*)

Tare. [O.F.] The vetch or tare somewhat resembles the pea. The "winter" vetch is sown in autumn, and is cut in May; spring vetches are sown in February. The vetch likes clayey or marly soil, and is cut little by little as fodder for cattle and horses, or sheep are penned upon it. The winter vetch is useful, as it comes when other forage is scarce.

Tarpau′lin or **Tarpau′ling.** A piece of coarse canvas covered with tar to keep out wet.

Tar′tan. Woolen cloth woven in stripes or checks, formerly much worn by Scottish Highlanders, whose clans were known by the different-colored tartans. *Trews* are trousers made of tartans.

Tea. [Chin.] The leaves of the tea-plant. The tea-plant, chiefly cultivated in China and in Assam, is a low bushy shrub, bearing a small white flower, and having leaves with saw-like edges, like those of the rose. Either black or green tea can be made from the leaves of the same plant. For *black* tea, the leaves are picked and exposed to the air in large heaps for one or two days. They are then placed on tables, and rolled by hand, and then dried or roasted in large iron pans, when their color changes to a dark, almost black, hue. For *green* tea, the leaves are dried almost as soon as picked, when they preserve much of their natural color. The dried leaves of the tea-plant contain a white crystalline substance called *thein*. When boiling water is poured on the leaves, thein, or the active principle of tea, is dissolved out. The liquid so obtained is called an "infusion." Green tea contains rather more thein than black tea, and so produces a stronger infusion. Tea is a favorite table beverage from its stimulating properties. The cultivation of this plant in the Southern United States has proved successful.

Teak. [Malabar.] A tree found in India, the East Indies, and in Africa, the wood of which is very hard and durable. It is used in ship-building, and in the construction of buildings.

Teal. [O.E.] A small fresh-water duck. The male is handsomely colored, and has a bright green or blue patch on the wings. In America teals are valued as game birds.

Telau′tograph. A form of telegraph, invented by Prof. Elisha Gray, by which writing and drawings can be transmitted and reproduced in fac simile.

Tel′egraph. [Gk. *tele*, far; and *graphein*, to write.] Stretched wires along which messages are sent by electricity. (See *Electric Telegraph.*) The messages are given by a pointer in the Wheatstone, by a fillet of paper in Hughes's, by dots and dashes in Morse's, and by symbols in Bain's system.

Telep′athy. [Gr. *tele.*, far; pathos, feeling with.] The supposed transfer of thought from mind to mind without speech or other physical communication. It is claimed that the thought of one person has been recognized by another through a distance of many miles.

Tel′pherage. [Gr. *tele.*, far; *pherein*, to carry.] A method of conveying goods along a suspended wire by aid of an electric motor. It has been used to carry ore from a mine and to convey logs from a forest.

Tele′phone. [Gk. *tele*, far; and *phone*, a sound.] An instrument which enables persons to talk to each other at considerable distances by electric wires. In its use a thin sheet of metal is set in vibration by the tones of a person's voice. These vibrations cause rapid alternations of strength in a current of electricity passing through a wire. At the opposite end of the circuit the varying currents act to set a second thin plate in vibration, and sounds are conveyed to the listener's ear like those of the speaker's voice. In this way the human voice can be transmitted for more than a thousand miles, and by a recent invention may soon be heard several thousand miles away.

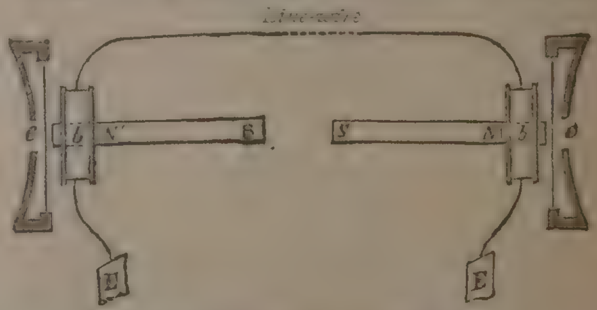
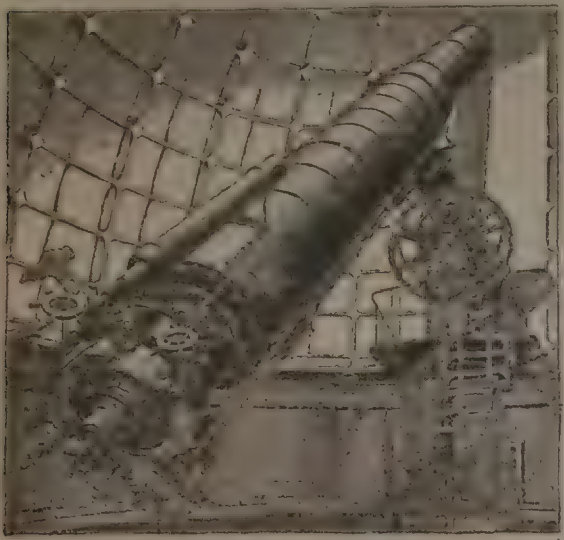


DIAGRAM OF TELEPHONE TRANSMITTER.

NS, N′ S′ cylindrical steel magnet surrounded at one end by a coil of wire, *bb′*, whose ends are connected by wires, with line wire and the earth, *E e*, is mouthpiece in front of which is a very thin sheet of metal which vibrates.

Tel′escope. [Gk. *tele*, far; and *skopein*, to see.] An instrument consisting of a tube and magnifying glasses for seeing things at a distance. In reflecting telescopes the image is formed by one or two concave mirrors, a large one at the lower end and a small one at the upper end. Sir William Herschel's telescope contained one

mirror. In refracting telescopes the image is formed by refraction in an object-glass, and is magnified by an eye-glass. The largest refracting telescopes, made by Alvan S. Clark, are that at the Lick Observatory, Mount Hamilton, California, which has a 36-inch object-glass, and magnifies from 180 to 3,000 diameters; and the Yerkes of the Chicago University, with a 40-inch object-glass and 64 feet of focal length. One of 48-inch object-glass was shown at the Paris Exposition of 1900. The Lick telescope separated the closest double stars known to us, and discovered the fifth satellite of Jupiter. Lord Rosse's telescope at Parsonstown is a reflector with 72-inch aperture. Common's reflector at Ealing is 5 feet in diameter. If the brightness of a star seen with the eye alone is one, with a 2-inch telescope it is 100 times as bright; with a 4-inch telescope it is 400 times as bright; with an 8-inch telescope it is 1,600 times as bright; with a 32-inch telescope it is 25,600 times as bright; with a 36-inch telescope it is 32,400 times as bright. That is, stars can be seen with the 36-inch telescope which are 30,000 times fainter than the faintest stars visible to the naked eye.



THE LICK TELESCOPE.

Tem'perature. [L.] The amount or degree of heat in any person, place, or thing; the condition which indicates whether heat will flow from one body to another, the body parting with heat being said to have a higher temperature, and the one receiving it a lower temperature than the other. In practice, temperature is measured by the expansion produced by heat in a liquid or a gas in a thermometer.

Ten'dril. [Fr. from L. *tener*, tender.] The long, slender, leafless shoot of a plant by which it clings to a support. They are the ends of stems, as in the grape vine; axillary branches in the passion flower, or ends of leaves in the pea.

Ten'tacle. [L.] A kind of arm or fleshy process attached to the head or body of some insects and other animals, by which they feel, grasp, or move.

Ter'ra-cot'ta. [L. *terra*, the earth; *cocta*, baked.] A kind of pottery or baked red clay. (See *Brick.*)

Ter'rier. [Fr. *terre*, the earth.] A small dog that burrows into holes in the earth after rabbits, rats, etc. The Skye has long hair and drooping ears. English and black and tan have short, close, smooth hair and upright ears. Fox terriers are both smooth and rough in variety.

Thatch. [AS.] A covering of straw, reeds, or rushes for roofs of buildings or stacks of hay or grain. Palm leaves are used in the West Indies for thatching.

Thermom'eter. [Gk. *thermos*, hot; and *metron*, measure.] An instrument for measuring changes of temperature by the contraction or expansion of a liquid or a gas. The three scales at present in use are—(1) the Fahrenheit, in common use in Great Britain and the United States; (2) the Centigrade, used on the Continent and in scientific works generally; (3) Reaumur's scale, used in Russia. In Fahrenheit's scale the freezing-point is marked 32°F. and the boiling-point 212°F. the intervening space containing 180°. In the Centigrade scale the space between the two points is divided into 100 equal parts—the freezing-point being marked 0° C., and the boiling point 100° C. In Reaumur's scale the freezing-point is marked 0° R., and the boiling-point 80° R., the space between the freezing and the boiling-points being divided into 80 equal parts. Since 180° on the Fahrenheit scale correspond to 100° on the Centigrade, the length of one degree Fahrenheit is 100-180th or 5-9th of one degree Centigrade, and any reading on the Fahrenheit scale is converted into the corresponding Centigrade reading by the following rule: Subtract 32 and multiply the remainder by 5-9th. When very low temperatures are required an alcohol thermometer is used, because mercury freezes at about -38° F. Air is of great use in determining temperatures above those at which mercury can be employed (mercury boils at 660° F.). Other types of thermometers are *maximum*, *minimum*, and *solar radiation* or self-registering thermometers. (See *Fahrenheit*, *Reaumur.*)

Thim'ble. (From *thumb.*) A sheild for the finger, used in sewing. It is usually made of metal, and has on the outer surface small pits to catch the head of the needle. A machine-made silver thimble takes more than 20 men to make it. The silver is rolled into strips, cut, punched, edges turned, stamped into shape, indented, polished, and engraved.

This'tle. [AS.] A plant with prickles along the stalks and leaves. There are many varieties. The cotton thistle, the musk thistle, and the bull or spear thistle are used as national emblems of Scotland. Seeds of thistles have downy fibres, and are thus easily blown about and carried great distances.

Thrush. A large family of insect-eating birds, found in nearly all parts of the world. The wood-thrush is one of the most abundant American species, and is noted for the beauty of its song. The hermit-thrush and the mocking-bird (*q. v.*) are other American species. The brown-thrush, or thrasher, as it is called, is a handsome bird, with habits like those of the mocking-bird, which it ranks next to as a singer. The song-thrush of Europe, sometimes called the *throstle* in England and the *mavis* in Scotland, is much like the wood-thrush. The robin, the blue-bird, and the wren belong to the thrushes.

Thun′der. [AS.] The loud noise which follows lightning. The rattle of a discharge of atmospheric electricity.

Thyme. [Gk.] A pungent, sweet-smelling plant, much used to give a relish to seasoning and soups. Oil of thyme, distilled from it, is used in liniments.

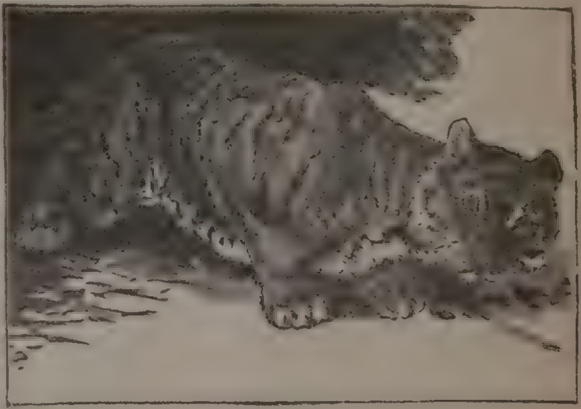
Tick. A species of insect parasites which are often very annoying. They are of minute size and have the mouth shaped like a sucker. They are found in thick woods on plants, and attach themselves to any animal that passes. They attach their sucker to the skin and work their way into the flesh, sucking the blood. They multiply so fast that many horses and cattle die from exhaustion, due to loss of blood. The ox-tick, when filled with blood, is half an inch long. The water-tick, another variety, always lives in the water.

Tides. [AS.] The rising and falling of the sea, caused by the moon's action. Owing to gravity, the moon exerts an attraction on every part of the earth, whether liquid or solid, but only the liquid parts which constitute the ocean are free to yield to the attractive force. When the moon is overhead, the water is drawn outwards and heaped up on the side of the earth next the moon. The projecting portions of the water under the moon, on both sides of the earth, represent the positions of high tides, while the low tides occupy the intermediate positions, and we experience what is called high or low water, according as the higher or lower part of the wave reaches our shores. The sun as well as the moon produces tides; but owing to its greater distance, the effect produced by the sun is small in comparison with the attraction of the moon. When the sun and the moon act together we have *spring tides;* when in opposition we have *neap tides.* When the tide rushes up a narrow channel, it rises to an unusual height. In the Bay of Fundy the rise and fall is not less than fifty feet, and in the Bristol channel there is a rise of about thirty-eight feet at spring tides. In the Mediterranean the tides have only a small range, varying from one to two feet.

Ti′ger. [Gk.] A carnivorous quadruped, like the lion in all its habits, except that it roams about by day as well as by night. In color it is yellow, with black stripes across the body. Its body is longer and stronger than the lion's, but shaped more like a cat's. It has no mane. Its under part, as well as the chest and throat, are white, and so are the long hairs on each side of its face. The tail is like a cat's in shape, and has no tuft at the end. The tiger is found chiefly in India and Ceylon. Indian princes hunt it with elephants.

Tile. [AS. *tigel.*] A piece of baked clay of a curved or flat shape used in roofing houses or for drains. (See *Brick.*)

Tin. [AS.] A metal white, like silver, easily melted or beaten out. Owing to the fact that it does not tarnish either in dry or moist air, it is much used for cooking-vessels, especially in the form of tin-plate. Tin is also used in the preparation of several important alloys, such as bronze, pewter, Britannia metal, bell-metal, etc. It does not occur in the native state, the tin of commerce being obtained from the dioxide, known to miners as tinstone. The chief European supply of this mineral is derived from the mines of Cornwall. It is also met with in the Malayan peninsula, the isle of Banca, and Australia. Deposits have been found in the United States, but none that paid to work. In order to prepare the metal, the tinstone is broken into fragments; and as it remains among the *debris* unchanged in character, it can, like gold, be separated from the lighter portions of rock by washing. It is then reduced to the metallic state by roasting in a furnace.—*Tin-foil,* tin beaten out very thin, like a leaf.



TIGER.

Tin-plate. The name given sheet-iron coated with tin. It is largely manufactured in South Wales, and of late years in the United States. The plates are dipped in acid and afterwards washed in water to insure their being perfectly clean. They are then toughened by passing them between polished rollers, coated, and passed between steel rollers. Tin-plate is used extensively in the manufacture of kitchen utensils, and for the tins required in preserving meat, fruit, and vegetables.

Tin′sel. [Fr.] A thin kind of cloth interwoven with gold or silver threads, or thin metal covered thinly with gold or silver.

Tint. [Fr.] A shade of a color. Red and black make brown; red and yellow, orange; blue, black, and red, olive; blue and lead, pearl; blue, white, and lake, purple; blue, white, and black, pearl gray; white and lake, rose; white and brown, chestnut; white and carmine, pink; white and green, bright or pea green; white and lampblack, lead; white and purple, French white;

white and yellow, straw; white, yellow, and red, cream; white, yellow, and Venetian red, buff; white, lake, and vermillion, flesh color.

Tit′mouse. [O.E.] A little song bird which feeds on insects. The blue, marsh, crested, and long-tailed titmice are the best known European species. The chickadee or black-cap tit is a common American species, and the tufted tit the largest. *Tit* is the titlark; *tomtit* is the blue titmouse or the wren.

Toad. [AS.] A crawling animal like the frog, but without teeth, and more terrestrial in its habits. It has a thick and heavy body, covered with wart-like glands, which secrete an acid fluid. The tongue is well developed, and can be protruded rapidly to capture insects. The skin absorbs moisture, and is cast off at intervals and swallowed. The winter is spent in a torpid state in holes and crevices. Toads are long-lived, and are found all over the world. They feed on insects injurious to vegetation. Tree-toads have loud, shrill cries, and are often brightly colored. The Surinam toad of Guiana is eaten by the natives. Its eggs are not laid in water, but are received by the male, who deposits them on the back of the female, where the skin thickens between the eggs, till each is invested in a sac, in which the young go through changes, and each emerges a perfect toad.

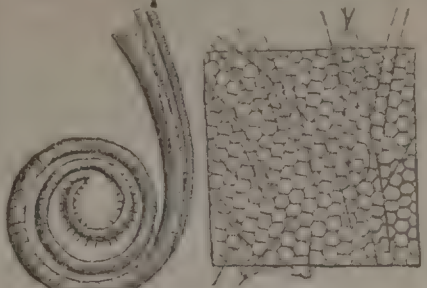
Tobac′co. [Span., from Ind.] A plant of the Nightshade family, the leaves of which when dried are used for smoking. It was found in America—in use among the Indians—by the Spanish discoverers. The plant is four or five feet high, has a moist, hairy stem, and leaves sometimes two feet long. The leaves are arranged round a single stalk, and the flowers, which are white and shaped like a funnel, grow at the top of the plant. Only plants grown for seed are allowed to blossom. It is grown in the West Indies, in the southern United States and in other countries. Much is grown in the Philippine Islands. Tobacco leaves rolled up tightly form cigars. The leaves are also twisted, pressed into cake, or cut fine. In making chewing and smoking tobacco in the United States, the leaves are sweetened, colored, and flavored with molasses, liquorice, salt, soda, saltpetre, and aniseed. Snuff is the leaf and stalks ground into powder. Much tobacco is used in the form of cigarettes.

Tobog′gan. An Indian sledge, made of a piece of birch-bark, with the front end turned up, and a rope attached to drag it over the snow. This became much used by the white settlers in Canada, and is now employed in the sport of sliding down a hill of snow, or a timber slope called a *toboggan slide.* In this form it is made of hickory splints, 5 to 15 feet long.

Toma′to. [Span.] An annual plant of the Nightshade family; also its fruit, which was formerly called *love apple.* It is of a red or yellow color. The tomato is of South American origin, but is now an important article of diet in the United States, England, France, and Italy. Its stem is weak, its leaves irregular, and both are clothed with hairs of a resinous substance. It has yellow flowers, and its fruit requires a high temperature to ripen.

Tongue. [A.S.] The fleshy movable organ of the mouth, used to taste or speak. In some insects, as the butterfly, it is a very curious organ.

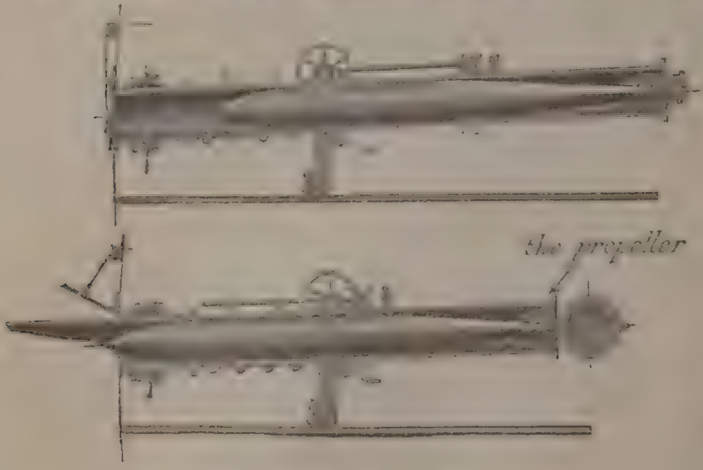
Tooth. [AS.] A small, hard body in the jaws, used for biting and chewing food. Like the nails and hair, teeth may really be considered as portions of the skin made compact and dense by the deposit of various mineral substances. Man has *two sets* of teeth; the first set, the milk-teeth or temporary teeth, are twenty in number. They are got when two years old. At six years the permanent teeth, growing up from beneath the milk-teeth, push the latter out, and at ten all the temporary teeth have been replaced by permanent teeth, altogether thirty-two in number—sixteen being placed in the upper, and sixteen in the lower jaw. Teeth are of different shapes, because some are intended for one purpose, and some for another. The part of the tooth imbedded in the gum is called the *fang*, while that above the gum is known as the *crown;* the crown of each tooth is overlaid with a pearly-white enamel. The eight teeth in the front of the mouth—four in the upper, and four in the lower jaw—have sharp cutting edges like chisels, and are called *incisors;* they are useful for biting or separating food. One on each side above and below are the four *canine teeth* or eye-teeth, called *canine* because they are so large and prominent in the dog (Latin *canis*, a dog), and also in all beasts of prey. These canine teeth are useful for *tearing* and for biting the food. Farther back in the jaws are eight teeth (two on each side above and below) called *pre-molars*, because they are next to the *molars*, twelve large teeth which occupy the hinder parts of the jaws. Both molars and pre-molars are mainly useful in *grinding* the food; whence their name, from the Latin word *mola*, a mill. The four last molars at the ends of the jaws are called the "wisdom teeth," because they are the last to be cut, usually not making their way through the gum till the age of twenty one. The teeth are not perfectly solid. Inside of each tooth there is a little hollow called the pulp-cavity, which contains several nerve-branches. These nerves pass along each fang into the gum, and are there connected with other nerves which go to the brain. When from any cause the enamel of the tooth is worn away, the delicate contents of the pulp cavity are exposed to the air, and to pressure from any little hard bits of food which may get inside the hollow place. Cold or pressure on the nerves produces the intense pain called toothache.



TONGUE AND EYE OF BUTTERFLY.

To'paz. A mineral ranked among the precious stones. It is found in Scotland, Cornwall, Saxony, Siberia, the United States, Mexico, and Brazil. The finest varieties are found in Brazil and the Ural Mountains, and are of a deep yellow tint, while those of Siberia are blue, the other colors found being white and green. They are frequently found in the cavities of granite rocks, and consist of a silicate of alumina in which fluorine takes the place of oxygen. It is next to the sapphire in hardness. The topaz of the ancients, obtained from *Topazos*, an island in the Red Sea, was *chrysolite.*

Torpe'do. [L.] A kind of fish related to the rays, with the power of giving an electric shock; also an explosive below the water to explode an enemy's ship when touched or fired by electricity, or a sub-marine boat carrying the explosive.



SELF-PROPELLING TORPEDO.

Torpe'do boat. A recent form of naval vessel used to discharge torpedoes against a hostile vessel for the purpose of destroying it. These vessels are small and very swift, some of them making over 30 knots an hour. As yet they have not proved very serviceable in naval warfare.

Tor'toise. [Fr., from L. *tortus*, twisted.] A creeping and swimming animal (so called from its *crooked* feet) covered with a hard shell, with openings for the head, legs, and tail. The tortoise is also called *turtle*, but this name is sometimes restricted to the marine species, *tortoise* to the land species, and *terrapin* to fresh-water species. Tortoises are mostly used for food; and the green turtle, a marine animal, is extensively used for soup. The common box tortoise is more thoroughly protected than ordinary turtles, because it has joints at the bottom of the shell, and can draw up the under parts all round the edge of the box.—*Tortoise-shell.* The shell of the hawk's-bill turtle, separated into thin plates, softened in hot water, and shaped in molds, in which it may be impressed with ornamental figures. It is used for combs, knife-handles, etc.

Tou'can. [Braz.] A fruit-eating bird, with a very large but light and thin beak, often as long as the body of the bird. It is brightly colored.

Tour'maline. A mineral found frequently in granite, gneiss, and mica schist. Some varieties are more or less transparent, others opaque. The transparent colored kinds are used as jewels, and prisms of tourmaline are used in experiments on the polarization of light.

Tow'er. [Fr. from L. *Tunis.*] A building of considerable height used for observations or for architectural effect. *Gay-Lussac's* and *Glover's towers* are used in making sulphuric acid. *The Tower of London* is famous in history as a State Prison. The *Leaning Tower* of Pisa, Italy, is 180 feet high, and is 14 feet out of perpendicular. The *Eiffel Tower*, Paris, is 985 feet high and built in 1889.

Trade-winds. Persistent winds which rise in the torrid and lower temperate zones and blow steadily towards the equator, being deflected westwardly by the earth's rotation, so that they become northeast or southeast winds, as they are north or south of the equator. They are caused by the ascent of heated air in the equatorial region, and the inflow of colder air to take its place. The ascending air outflows to the north and south and gradually descends to the surface, making what are known as *anti-trade* winds. The trades diverge to the north or south as the sun does so in its annual round.

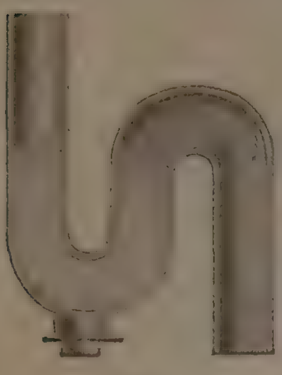
Tram'way. [E. *tram*, a bar; and *way.*] The English term for a street railway; a road laid with beams or rails, on which wagons or carriages can run easily.

Trans'it instrument. An instrument for detecting the time of transit of a star across the meridian. It consists of a telescope mounted on a horizontal axis.

Trap. [AS.] A contrivance to prevent the passage of offensive gases along a drain. The siphon trap, which is perhaps the best and simplest, is merely a bend in the pipe, which remains filled with

THE LEANING TOWER OF PISA.

water. There ought to be traps placed where the pipes from the inside of the house join the drain, and there should also be a trap just where the drain joins the sewer. But drains and sewers ought both to be *ventilated*—to have openings for the bad gases to escape.



TRAP.

Trapeze′. [Gk.] A swinging bar, hung from a roof, on which athletes perform.

Trawl. [Fr.] A net like a bag used for catching fish. It is attached to a beam with iron frames at its end, and is dragged at the bottom of the sea.

Trea′cle. [Fr., from Gk. *theriaka*, drugs for healing the bites of wild beasts.] Molasses drained from sugar-refining molds.

Tre′foil. [Fr., from L. *tres*, three; and *folium*, leaf.] A three-leaved ornament, like the three-leaved clover.

Trel′lis. [Fr., from L. *trichila*, an arbor.] A kind of network made by crossing strips of wood or iron, for supporting climbing plants, or as a screen.

Tre′pan. To take out a portion of the skull in case of injury to the head or disease of the brain. This is done by means of a small circular saw, which cuts out a round piece of the bone. In healing, the bone throws out granulations, which gradually ossify, but do not quite close up the opening.

Trichi′na. A minute worm which infests the intestinal canal of certain animals, including man and the hog. This is in the adult procreative state. The young, larval trichinæ bury themselves in the muscles, where they exist as spirally-coiled worms in minute cists. Their danger to man is in their immense numbers. In a cat, a single ounce of flesh was estimated to contain 325,000 trichinæ. They enter man principally through partly cooked pork. Thorough cooking destroys them and obviates the danger of infection.

Tri′cycle. [Gk.] A vehicle with three wheels, one or more of which are turned by the feet by means of pedals.

Trout. [AS., from Gk. *trogein*, to eat.] A beautiful silvery fresh-water fish of the genus *Salmo*, very much prized for food, and a favorite fish for anglers. The most important are the brown-trout and the salmon-trout. Its habits are solitary and very predaceous. It feeds upon worms, minnows, insects, and caterpillars. The minnow is the most taking bait for large trout. The trout is found in lakes and rivers, but the most brilliant and beautiful fishes are found in streams flowing over chalky and rocky soils. River-trout attain to a length of 30 inches. Sea-trout or bull-trout are found 3 feet in length.

Tridac′na. The largest of the bivalve molluscs. A single shell has been known to weigh more than 500 pounds. The valves are deeply furrowed and handsomely grooved, and are used as ornaments for grottoes and fountains. The animal is edible, and one makes a meal for several persons.

Tri′lobite. A fossil crustacean belonging to the primary geologic age. There are numerous species in the Silurian and Devonian periods and a few in the coal strata,—named from their three-lobed bodies. Their nearest modern representative is the King-crab.

Trol′ley. Formerly a small truck or set of wheels carrying a box or car-body. Now a grooved wheel which robs in contact with an electric wire, and takes off the current to transmit it to the motor of an electric or *trolley* car beneath.

Trump′et. A wind musical instrument with a clear and ringing tone. Its scale in the lower octaves is limited to the first natural harmonics, but by valves or pistons trumpets can produce every note in their compass.

Tset′se fly. An African insect, whose bite is harmless to man, but nearly always fatal to the ox, horse, or dog. It is about the size of the common house-fly, and lives by sucking blood. It is thought to transmit a disease germ to the blood.

Tube-rose. A variety of the primrose, cultivated in gardens for its vari-colored, gay-looking flowers.

Tu′lip. [Fr., from Per., a turban.] A garden plant growing from a bulb, and so called because of its supposed likeness to a turban. In the seventeenth century the cultivation of tulips in Holland became a mania, and tulip-bulbs were sold and resold as stocks on 'Change.

Tulle. [Fr.] A kind of thin silk or muslin netting for veils; so called from Tulle, a town in France.

Tum′bler. A large drinking-glass, formerly so made that it could not be set down without tumbling over, and thus requiring the liquid to be finished at one draught; a kind of pigeon which tumbles when flying.

Tun′ing-fork. An instrument of steel like a fork, which when struck gives out a fixed tone taken as a key-note.

Tun′nel. [Fr.] A passage underground or through a hill. The St. Gothard tunnel is 9½ miles long (48,840 feet); that of Mont Cenis, 39,840 feet; Hoosac, 25,080 feet; that under the Mersey 4½ miles, including approaches. Tunnels are now blasted out with nitro-glycerine fired by electricity.

Tun′ny. [Gk., to dart along.] A large fish of the Mackerel kind, found in the Mediterranean and Atlantic.

Tur′bine. [L.] A water-wheel with curved floats or buckets, against which the water acts either from above downward or from below, or inward from an external casing.

Tur′bot. [Fr., from L. *turbo*, a whipping top.] A large, round flat-fish of the Flounder kind, used for food. The upper side is brownish and lower side white. It is voracious and feeds on other fishes. It is abundant in the North Sea. At one catch off Jutland 240,000 were caught, averaging more than one pound each. There are no turbots on the American coasts.

Tureen′. [Fr., from L. *terra*, earth.] A large, deep dish of earthenware in which soup is served.

Tur′key. A large scratching fowl, which received its name because it was by some supposed to come from Turkey, but really a native of North America. It is now bred in many countries. The tame turkey is duller in hue of feathers, but is generally much larger than the wild turkey. Its flesh is much valued, and in the United States roast turkey is the favorite Christmas dish.

Tur′meric. The root of an East Indian ginger-like plant. It is used as a curry, to give color to varnishes, to dye silks and woolens yellow, and as a test for alkalies.

Tur′nip. [Fr. *tour*, a turn; and AS. *naep*, a turnip.] A plant with a large round root, tapering downwards. A native of Europe and the temperate parts of Asia. It is a common garden vegetable, and in many countries it is largely grown for sheep and cattle food. The Swedish turnip, or *ruta baga*, is much used in Europe for this purpose.

Tur′pentine. [Gk. *terebinthos*.] The oily resin of the terebinth and some kinds of larch, fir, and pine. A cut is made through the bark of the tree, and the sap flows into jars. This is viscous like honey, and is crude turpentine. Oil of turpentine is distilled from crude turpentine, the solid part being yellow resin, used in making soap. Turpentine is used extensively in mixing paints and varnishes, and is also used in medicine.

Turquoise′ (*turkois*). [Same word as *Turkish*.] A precious stone of bluish-green or sky-blue color, brought from Persia. It is a phosphate of aluminium, its color being due to the presence of iron or copper.

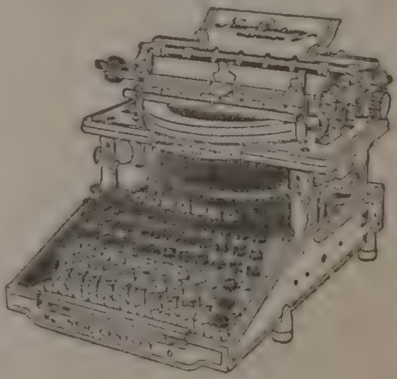
Tur′tle. [From Span. for *tortoise*.] A reptile enclosed in a double shield or shell, from which the head, legs, and tail are protruded, but under which they can be drawn. The shell is an expansion of the vertebræ and ribs. Turtles do not shed their shells, and have no teeth, but have horny jaws. They are ocean swimmers, coming on shore only to lay their eggs in the sands. Some of them are very large. The name is also often given to the land tortoise. (See *Tortoise*.) The green turtle is much esteemed as a table delicacy.

Tusk. [AS.] A very long, pointed tooth on each side of the mouth, found in certain wild animals, as wild boars, elephants, etc.

Twi′light. [AS. *twi*, double; and *light*.] The dim, faint light before sunrise or after sunset. It is produced when the sun is 18° below the horizon by the reflection of the sun's light from the higher regions of the atmosphere. In the tropics the duration of twilight is shorter than in more northern latitudes.

Tym′panum. [Gk.] The drum of the ear (*q. v.*)

Type. [Gk. *typtein*, to strike.] A letter cast in metal in a mold or cut in wood for printing. Including fancy types, some three or four hundred varieties of face are made. Besides ordinary Roman and Italic, the varieties most in use are Old English, Old Style, Clarendon, Antique, Black Letter, and Script. The principal sizes are—Ruby, Diamond, Pearl, Agate, Nonpareil, Minion, Brevier, Bourgeois, Longprimer, Small Pica, Pica, English, Greatprimer. Type-metal is an alloy of lead and antimony, sometimes with a little tin or nickel or copper. In type-founding a punch or die is first made on the end of a bar of soft steel, and then hardened; then a matrix is made in copper, with a mold or box in two parts for casting.



TYPEWRITER.

Typewriter. A machine which is used to print Roman letters in place of script writing—for all work usually done with a pen. There are many kinds, but most of them have key boards; by depressing these types are pressed against the paper through an inked ribbon.

Ty′phoon. A ferocious whirlwind or tornado, common in the China seas, and of irresistible violence.

U

Um′ber. [Fr., from L. *umbra*, shade.] A brown or reddish kind of earth, consisitng of clays mixed with oxides of iron and manganese. It is used in oil and water-color painting.

Umbrel′la. [L. *umbra*, shade.] A shade or screen used as a protection from the rays of the sun or from rain. It is formed of strips of whalebone or steel fastened to a stick or hollow iron rod and covered with silk, cotton, or alpaca. Umbrella silk is made chiefly in Lyons and Crefeld.—The *umbrella tree* is an American magnolia with white flowers and rose-colored fruit, the leaves being crowded on the top of the flowering branch in an umbrella-like circle.

U′nivalve. A mollusc whose shell consists of only one piece, as distinguished from the bivalve, or double-shelled molluscs, like the oyster. The univalves are the most numerous of the molluscs, and differ very greatly in size, shape, and color, many of them being very graceful and beautiful. A familiar example is the land snail.

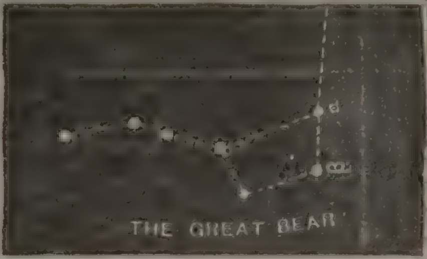
U′pas. [Malay.] A poison, used to poison arrows, contained in the upas trees, a native of Java and Borneo. It was formerly supposed to have fatal effects, from its severe narcotic properties, to all animals which came under its shade. These stories are fabulous, but it exudes a gum resin which is very poisonous. It belongs to the bread-fruit genus.

U′ranium. [From the planet Uranus, discovered about the same time.] A metal discovered in 1789, as a constituent of several minerals. It is a very hard metal, resembling nickel and iron in appearance. Peroxide of uranium is used to color glass green or greenish-yellow, and a sub-oxide is employed in porcelain painting to produce an intense black. The metal is rare and costly.

U′ranus. The planet next beyond Saturn, and supposed to be the outermost until the discovery of Neptune. Its distance from the sun is 1,771,000,000 miles; its diameter 31,700 miles; its year 84 earthly years in length.

U′ric Acid. A crystalline body present in the urine of man and of most mammals, and sometimes called lithic acid, because of its presence in calculus.

Ur′sa. [L.] The Bear—a name given to two groups of stars near the north polar star. The Ursa Minor, or Lesser Bear, contains the pole star. The Ursa Major, or Great Bear, consists of a group of seven bright stars, two of which—*the pointers*—point to the pole star.



V

Vaccina′tion. [L. *vacca*, a cow.] Jenner in 1796 noticed that persons who had much to do with cows, and who had caught from these animals a mild disease known as cow-pox, did not afterwards catch small-pox. The *lymph* by which the cow-pox is transmitted is a clear fluid obtained from a cow or a calf, or from the swelling on the arm of a vaccinated person. This lymph is introduced into the body by scratching the arm and then rubbing into the blood the lymph from little glass tubes.

Vac′uum. A space devoid of matter. The term is ordinarily applied to the results of the exhaustion of air from a chamber of glass or other substance. The vacuum produced by the air pump is far from perfect, and various means are in use to produce a more complete exhaustion. A very efficient one is the Sprengel pump, in which mercury flows down a long tube of narrow bore, and carries with it the air from a connected vessel. The best vacuum obtainable by the air pump is 150 times the millionth of an atmosphere; while the Sprengel pump yields .005 of the millionth of an atmosphere.

Val′ance. [Fr. *Valence*, a town near Lyons.] The hangings round a window or the lower part of a bed.

Valve. [L. *valva*, the leaf of a folding door.] A kind of flap or lid in a pipe or a blood-vessel which allows a fluid or gas to flow only in one direction, as in the common pump. There are a flap-valve, puppet-valve, ball-valve and slide-valve. A *safety-valve* is held shut by a spring or weight, and opens automatically to allow steam, gas, or water to escape when the pressure becomes too great. The valves in the blood-vessels assist the flow of blood through the veins.

Vanil′la. A climbing plant, native of Mexico and tropical America, with long pod-like capsules and a delicate odor. From it is extracted an oil used in confectionery and perfumery. The pods are cut and ground, and mixed with weak alcohol.

Var′nish. [Fr., from L. *vitrum*, glass.] A liquid laid on a surface to make it glossy. According to the solvents used, varnishes are divided into spirit, turpentine, and oil varnishes. The chief resins used in varnishes are copal, mastic, lac, benzoin, amber; and these are mixed in alcohol, turpentine, ether, linseed and olive oils.

Vas′eline. A yellowish, translucent, and odorless substance, obtained in the purifying of crude petroleum, used as an ointment and in the arts.

Vault. [Fr., from L. *volutus*, rolled.] A roof or ceiling in the form of an arch, or an underground room with arched roof. A groined vault has the roof groined, or with different cylindrical surfaces intersecting one another.

Veg′etable. [L.] A plant grown for food, as the cabbage, potato, turnip, etc. The *vegetable kingdom* is the primary division of living things, which includes all plants, and is divided into *Phanerogamia*, or plants having distinct flowers and seeds—sub-divided into exogens (*q.v.*), endogens (*q.v.*), and gymnosperms; and *Cryptogamia*, or plants without true flowers, and reproduced by minute spores,—subdivided into ferns, mosses, and liverworts, and the algæ, fungi, and lichens.

Vegeta′tion. The growth of plants. Vegetation occurs over the whole globe under the most opposite conditions. Plants flourish in the bed of the ocean as well as on land; under the extremes of cold and heat in the polar and equatorial regions; on the hardest rock and the soft alluvium of the plains; amid the snow of the mountains, in boiling springs, in dark caverns or mines. Different circumstances produce different species and genera. Absence of humidity, and extremes of temperature, are the conditions fatal to vegetable life. Trees and plants which occur in the plains dwindle with increased elevation. Plants are capable of extended naturalization, but distinct vegetable regions occur in different zones or on different heights.

Vel′lum. [L. *vitulus*, a calf.] Calf-skin prepared for writing, and finer kinds of parchments.

Veloc′ipede. A vehicle propelled by the feet of the rider. The common form is the two-wheeled bicycle, but tricycles and quadricycles are somewhat in use.

Vel′vet. [Ital. *velluto*.] A pile formed of silk, or a mixture of silk and cotton, by short pieces of thread crowded together, or woven with a third set of threads so closely that they stand up and hide the warp and woof. The rows of loops are slit with a sharp knife. *Cotton velvet* is an imitation velvet made of cotton, and sometimes called velveteen.

Veneer′. [Fr.] A thin slice of wood of one kind glued on the surface of another to give it a good appearance. (See *Wood*.)

Ve′nus. The second planet in order from the sun, from which it is 67,000,000 miles distant, and around which it revolves in nearly 225 days. Its diameter is about 7,760 miles, very near to that of the earth. The length of its day is not known.

Veran′da. [Port.] A kind of covered gallery or balcony in front of a house.

Verbe′na. [L.] A herbaceous plant with beautiful flowers. *Essence of verbena* is prepared from the lemon verbena, a plant with a lemon flavor.

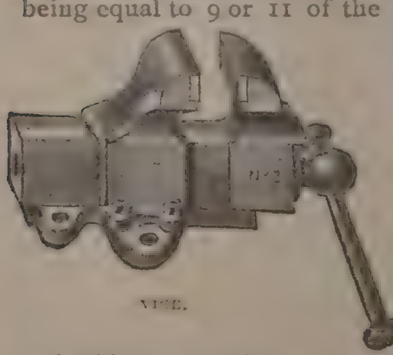
Ver′digris. [L., green of brass.] Acetate of copper; poisonous green rust formed on brass or copper. It is used for making green paint and for dyeing wool black, in gilding and in calico printing.

Vermicel′li. [Ital., from L. *vermis*, worm.] Dough of wheat flour forced through small pipes or holes into *worm*-like threads. *Macaroni* is made through larger tubes.

Vermil′ion. [Fr., from L. *vermis*, worm.] A bright scarlet color got from the cochineal *worm* or insect. The vermilion of commerce is got by heating sulphur and mercury, and also by electricity. It is used in painting and in making sealing wax.

Ver′nier. A small scale made to slide along the edge of a larger one, 10 divisions of the smaller being equal to 9 or 11 of the larger. Invented by Pierre Vernier to measure tenth and hundredth parts.

Ver′tebra. [L., a joint.] One of the twenty-six separate bones, called vertebræ, firmly united together to form the spinal column or backbone (*q.v.*) in man and the higher animals.



VICE.

Vice. [Fr. *vis*, a screw.] An instrument with two strong jaws, closed by a screw, lever, or cam, for holding things firmly when being filed. In the blacksmith's vice the front jaw reaches down further than in the machinist's and is loosely fastened at the bottom. Carpenters use wooden vices.

Vine. [Fr., from L. *vinum*.] A climbing plant bearing grapes from which wine is made. All the European varieties are supposed to belong to one species, *Vitis vinifera*. The chief districts are France, Spain, Portugal, Germany, Austria, and Italy, and this species is also grown in various other parts of the world, including California. There are several different species in the United States. (See *Grape*, *Wine*.)—Also any climbing or trailing plant, as hop vine, etc.

Vin′egar. [Fr.] A sour liquid, used as a relish for food, made from wine, cider, beer, malt, etc. The sourness is due to the presence of acetic acid, and of this there is from 3 to 5 per cent.

Vi′olet. [Fr., from L. *viola*.] A low creeping plant with a small flower, having a delicate fragrance. *Sweet violet* is the *Viola odorata*. *Pansy* is the *Viola tricolor*, and is also called heart's-ease.

Vi′olin. [Fr.] A musical instrument with four strings, played with a bow. Its tones are brilliant and of great power and variety, and in the orchestra it is the leading and most important instrument.—*Viola*, a violin a fifth lower in compass than the ordinary violin.—*Violoncello* [Ital.], a large bass violin with four strings, an octave lower than the viola.

Vi′per. [Fr., from L. *vivus*, living; and *pario*, I beget.] A poisonous serpent; so named because it was the only serpent that was supposed to bring forth its young *alive*. The varieties include the common viper, the asp, the African horned viper, with a horny scale over each eye, Indian viper, and the red viper or copper-head, an animal like a rattlesnake without the rattles.

Vi′tascope. A moving series of photographs, giving the appearance of a living picture. Various names are given to the different forms of this, as biograph, mutascope, etc.

Vit′riol. [Fr., from L. *vitrum*, glass.] A *glassy*-looking substance consisting of sulphur and copper or zinc. Also the popular name for sulphuric acid (*q. v.*). *Blue vitriol* is sulphate of copper; *green vitriol* is copperas, or ferrous sulphate; *red vitriol* is a native sulphate of cobalt; *white vitriol* is zinc dissolved in sulphuric acid, and is a sulphate of zinc.

Volca′no. [Ital., from L. *Vulcanus*, god of fire.] A burning mountain, with an opening at the top called a crater, from which fire, steam, lava, cinders, etc., are thrown up.

Vul′canite. India-rubber (*q. v.*), or similar substance, hardened by heating with sulphur, and made into combs, buttons, etc.

Vult′ure. [L.] An important family of birds of prey. The neck of the vulture is bare, but at the lower part there is a loose fold of skin covered with feathers under which it draws its head to keep it warm. Vultures feed upon carrion, and seldom attack living animals. The condor, king vulture, turkey buzzard, griffin, and lammergeir are all vultures. The condor is the largest vulture of the New World and is found in the Andes. The lammergeir is found in Europe, Asia and Africa.

W

Wa′fer. [Fr. from Ger.] A thin cake of paste used in closing letters.—A thin cake or piece of ground bread used in the mass. This is usually unleavened, circular, and stamped with a crucifix or monogram.

Wag′tail. A small song-bird belonging to the genus *Motacilla*, and so called because it jerks its tail up and down. The common water wagtail is also called the pied wagtail. It is mixed white and black in color, and lives on the edges of ponds and streams. The *Wood wagtail* is found in Asia, and has a slender bill and short legs.

Wain′scot. A boarding or lining of oak or other timber in panels.

Wall-flower. A perennial plant with sweet-smelling flowers, growing in old walls and among ruins. It varies in color from yellow to orange and deep red.

Wal′nut. [AS.] A tree of large size, with alternate, pinnate leaves, found chiefly in North America. The black walnut is a beautiful timber tree found in the United States, with a heart-wood of a warm brown color, a favorite wood for furniture making. The nut is round and oily, enclosed in a hard shell with a fibrous outer covering. The white walnut is a North American tree with long oily nuts, and hence called butternut. It also yields a valuable wood. There are some species found in Asia, whose wood is used in cabinet making, and the nut used for dessert and pickling. The nut yields walnut oil used in cooking.

Wal′rus. [Du., from Scand., the whale-horse.] A large polar animal allied to the seal—also named *Morse.* Two of its upper teeth are prolonged into huge tusks, which measure from one to two feet, and weigh nearly five pounds. It is one of the largest animals of the frozen regions. It sometimes measures eighteen feet in length, and weighs a ton. It is hunted for the blubber or fat that encases its flesh, which yields oil, and for its ivory tusks. Like the seal, it is a very clumsy animal on land or ice, and it is always found near open water. All it wants is a comfortable spot to lie on, the sea being its refuge in times of danger. The walrus is caught by means of a barbed spear or harpoon, which is suddenly thrust into its body by the native hunter, who has crawled slowly and silently within striking distance.

Warp. [AS.] The threads running the long way way of the loom and crossed by the woof. (See *Spinning*, *Weft.*)

Wart. [AS.] A small, hard growth on the skin, generally on the hands.—*Wart-hog* is a large African wild hog with large fleshy tubercles or warts behind the tusks, and a second pair behind the eyes, and with a mane along its back.

Wasp. [AS.] An insect somewhat like the bee, but its wings when at rest are laid over the body, and it has a deep division between the thorax and abdomen. Some live in colonies and some alone. When winter approaches all the wasps die except the females, which sleep through the cold. The nests of social wasps are built of paper, beautifully variegated and very durable. The young of social wasps feed on insects and larvæ brought to them by the old wasps, who feed mainly on honey and pollen of flowers and sweet juices of fruits. Some wasps make their nests in holes in the ground, and others fasten them to walls or the branches of trees. The sting of the wasp is barbed like that of the bee. Dry seasons are favorable to them. Sugar in some fruits, as grapes and plums, most attacked by wasps, turns into alcohol in the process of rotting, and this makes wasps somnolent, but inclined to sting. The mud-wasp deposits a supply of stunned spiders with its egg in a cell for the larva to feed upon. Sand and wood wasps are solitary kinds. The females dig out cells in rotten wood with their jaws. Sand-wasps dig holes using the hairs on their legs. (See *Hornet.*)

Watch. [AS.] A pocket timepiece. The train of wheels is the same as in a clock, but the mainspring and balance take the place of the weight and the pendulum in a clock. Watches are made mostly in Switzerland, England, France, and the United States. American watches are all made by machinery, the parts being cut so as to fit in all watches of the same kind. Watches are distinguished by the kind of escapement used—as verge, lever, duplex lever, and chronometer watch; also by the cases they are enclosed in—as open-faced, and hunters and half-hunters, which have closed and half-closed faces. Keyless watches, wound up by a knob on the stem, have taken the place of those wound up by a key.

Wa′ter. [AS.] The fluid which falls in rain and forms rivers and seas. Like air, water was formerly considered a simple substance; but about a century ago the compound nature of water was discovered. Now it is a familiar fact that it is composed of two elements, oxygen and hydrogen, in the proportion of two parts of hydrogen to one of oxygen. At temperatures below freezing point (32° F.) water exists in the solid form of ice; between freezing point and boiling-point (212° F.) it takes the liquid form; and above boiling-point it exists in a gaseous state as vapor or steam. When the sun shines on the seas and rivers, the heat evaporates daily a quantity of water. Rising up into the air, and carried along by the winds, this water-vapor is condensed, and falls as rain. Rain-water is in reality a kind of distilled water. It is not perfectly pure, for in falling it dissolves some of the carbonic acid gas out of the air, and also brings down impurities as soot. Water containing carbonic acid dissolves limestone and gains a condition called hardness, which may be removed by boiling or by adding lime-water. Pure water is clear, without taste, and colorless. Water is most commonly seen in the liquid state, but it is easily converted into a solid or into a gas. When liquid water is cooled, it contracts, or becomes less in size, until it reaches 30°; if cooled still more, it begins slowly to expand; but when it is as cold as 32°, it suddenly expands, becoming about one-tenth larger, and forming the *solid* called ice. This is the reason why water-pipes often burst in frosty weather. The blood, which carries the food to all parts of the body, and removes the waste matter from every organ, is more than three parts water; more exactly, in 100 lbs. of blood there are 79 lbs. of water. Water forms about two-thirds of the total weight of the body. In 100 lbs., lettuce contains 96 lbs.; cabbage, 92; apples, 83; fish, 78; potatoes, 75; lean meat, 72; bread, 40; cheese, 34; rice, 15; butter, 10, parts of water.

A DROP OF WATER, MAGNIFIED.

Watermel′on. A fruit of a species of the genus *cucumis*, to which the cucumber also belongs, also the common musk-melon or cantaloupe. The watermelon plant is a running vine that bears a very large, round fruit, with dark-green spotted rind, and pink or white flesh, sweet in taste, and very juicy or watery. This makes it much prized in warm countries.

Wa′ter-gas. A kind of gas made by forcing steam over glowing coke. This yields a heat-giving mixture of hydrogen and carbon monoxide, which is charged with carbon and made suitable for illuminating purposes by passing through a volatile carbon.

Wa′terspout. A whirling storm at sea, similar in appearance to a tornado on land. From a dense cloud descends a conical pillar, of funnel-shape, under which the sea is violently disturbed, rising in a cone. Sometimes the two cones meet, but they more frequently disperse before meeting.

Waterwheel. A wheel turned by flowing or falling water and setting machinery in motion. There are three kinds, *overshot*, *undershot*, and *breast* wheels, named from the level at which the water strikes their float boards. A *turbine* is a horizontal wheel with a vertical axis, driven by the weight and impulse of the water as it falls on the vanes around the axis.

Wave. [AS.] A moving ridge or swell on the surface of water. Waves in deep water move onward, but the water of which they are composed is continually changing. Scoresby gave 600 feet as the maximum length of sea waves. In 1888 the *Umbria* was struck by a wave 50 feet high.—Heat, sound, and light are supposed to travel in waves. The *wave theory of light* regards its phenomena as due to transverse waves in an ethereal medium, their amplitude causing brightness of light, and their frequency causing its color. The colors of the spectrum are estimated to result from various rapidities of vibration, ranging from 459 to 727 millions of millions per second.

Wax. [AS.] A thick sticky stuff of a yellowish color made by bees (*q. v.*) to form cells for honey, and used in making sealing-wax (*q. v.*), in modeling and in making wax-cloth or floor-cloth. *Mineral wax* is a substance resembling wax, found in connection with deposits of rock-salt and coal, and is also called ozocerite. *Chinese wax* is secreted by the wax-insect used in candles and medicine. *Wax-palm* is a tree found in the Andes. Its stem is covered with a secretion consisting of resin and wax, which when melted with fat makes excellent candles. *Wax-bill* is an Asiatic and African finch-like bird with a beak red like sealing-wax.

Wea′sel. [AS.] A small flesh-eating animal with red and white soft silky fur. Its body is about seven inches long, its legs are short, and it has five claws on each foot. Its head is round, its muzzle sharp, its ears small and pointed, its jaws powerful, and it has whiskers like those of a cat. Its sense of smell is keen, its sight good, its hearing quick, and it glides like a snake, or runs swiftly, and jumps or climbs walls and trees with great ease. It is seldom seen during the day, but prowls at night in search of food. It feeds on rabbits, moles, mice, frogs, and birds. It is fond of blood, and likes to suck eggs in the poultry-yard, making a small hole in the end of the shell. Farmers favor weasels because they kill many vermin. In attacking their prey, they generally seize the animal by the back of the neck and drive their teeth into the brain. The weasel makes a nest of dry grass and leaves in a tree or ditch.

Weath′er. The state of the air at any time as regards heat, moisture, wind, rain, clouds, and electricity. The pressure of the atmosphere is an important factor in bringing about atmospheric changes, because air always flows from a region of high pressure to one of low pressure. The pressure of the atmosphere at any place is obtained from the readings of the barometer; but the direction and force of the wind depend upon the relative distribution of pressure at a given time over a large extent of country, and not upon the actual reading of the barometer at the particular place. Simultaneous observations are made at as many different stations as possible within the given area, and are communicated to a central station, where the readings are compared and the distribution mapped out. The direction of the wind can then be inferred from the fact that it blows from where the pressure is high to where it is low. The place where for the time being the pressure is lowest is said to be the seat of a barometric depression, and the heaviest fall of rain generally takes place in the neighborhood of such a depression. In the Weather Bureau of the United States, 83 per cent. of the forecasts given twenty-four hours previously have proved correct.

Weav′er-bird. A bird like a finch or sparrow, found in Asia and Africa, with hanging nest composed of interlaced grass. Some make their nests in the shape of a retort, with the opening at the bottom of the tube.

Wedge. [AS.] A piece of wood or metal, thick at one end and thin at the other, for splitting or fastening. The wedge is one of the six mechanical powers.

Weed. [AS.] Wild plants in cultivated ground. Weeds injure crops in several ways. They absorb some of the plant-food which has been prepared for the crop, and they keep air and sunlight from the cultivated plants, which look sick and weakly in consequence. The hoe is an instrument much used for destroying weeds. On a good farm, land is fairly *clean*, or free from weeds.—*Sea-weed*, any marine plant of the class Algæ, or any plant growing in the sea.

Weft. [AS.] The cross threads of a web carried by the shuttle from selvage to selvage, *woven* into the warp.

Well. [AS.] A deposit of water reached by a hole sunk in the earth. The water in *wells* is of the same nature as that of springs. Many towns are supplied with water from deep wells which reach beds of sandstone, lying perhaps 500 or 1,000 feet below the surface. The water of shallow wells in towns is almost certain to contain sewage, which has passed from cess-pools or leaky drains through the soil and gravel or sand until it has reached the well. (See *Artesian Well.*)

Whale. [AS.] A large swimming animal. The whale is not a fish, for its young are born alive, and are suckled, instead of coming out of eggs as young fishes do. Seals have feet that are more fitted for moving through the water than for moving on land; but whales cannot move on land at all, for they have no feet. Some kinds of whales are the largest animals in the world. Whales are sometimes found in large herds, or "schools" as they are called. They are killed for their oil by the harpoon (*q. v.*). When a harpoon has struck a whale, the rope fastened to its handle is quickly let out over the side of the boat, and the whale pulls it so swiftly that the men are obliged to pour water over it to prevent setting the wood on fire. When once a harpoon has pierced a whale, it can only be got out by cutting the flesh. A dying whale often struggles so fiercely that it is dangerous for a boat to be near it. The bomb-lance and gun now used in killing whales are safer and more expeditious. The sperm whale (*q. v.*) has very sharp teeth in its lower jaw, with which it can crush a boat. One monster actually destroyed nine boats. Its jaw is 16 feet long, 7 or 8 broad, and about 10 in height. The thrasher, a large and voracious shark with a long upper lobe on its tail, often beats or fights the whale. The Greenland whale, the rorqual, and one or two other kinds, have whalebone instead of teeth. The whalebone, of which there are 360 plates or pieces in one animal, is fastened to the upper jaw of the mouth, and hangs down. Each piece is from 10 to 14 feet in length, and is 11 inches broad at the root; and one whale yields one or two tons of whalebone. The blubber or inner skin, which contains the oil, may be 16 inches thick, and a large whale may yield 275 barrels of oil. The throat of the Greenland whale is so narrow that it can swallow only the very smallest animals, such as shrimps and small jelly-fish, which are caught as in a net by the brush-like fringes on the edges of the whalebone. The throats of the spermaceti and rorqual whales are much larger. The rorqual is the largest member of the Whale family. Some of them are 85 feet long. But they are so savage, and their oil and blubber so inferior, that whalers do not often attack them. The whale has no hair, but the blubber keeps the outer skin oiled, enables it to resist the water, keeps out the cold, and from its lightness causes the body of the animal to float easily. The whale moves by its tail, which is so strong that it enables the largest of these animals to leap right out of the water. It uses its fins, or fore limbs, to balance itself, and also to grasp its young, of which it is very fond. The whale cannot remain long under water, and must come up for air every little while. But the nostrils of the animal are placed on the top of its head, so that when it rises very little of its body is seen. These nostrils are called blow-holes, and through them it spouts up spray as well as its own warm breath to a great height. The sperm whale has only one blow-hole. When under water the animal can protect both nostrils and ears by a sort of round stopper of skin and muscle, which fits so closely that not a drop can get in. Whales, often in hundreds, feed on the outskirts of herring and other fish shoals. The dolphin and porpoise are smaller members of the Whale family.

Wheat. [AS.] One of the cereal plants from whose seeds bread is made. After Indian-corn, it is the most important of American food-plants, and is widely grown in the temperate regions of the remainder of the world. Rice replaces it in importance in the tropics and in China. Wheat is, on the whole, the hardiest of the cereals, though oats are grown in regions where there is not enough heat to ripen the wheat. It is also the most costly of the cereals, yielding less and exhausting the soil more. There are many varieties—*autumn* and *spring*, from the times of sowing; *red* and *white*, from the colors of the grains; *bearded*, having ears with awns; *beardless*, having none; and *rivetts*, with a coarse straw. An average crop is from 25 to 30 bushels of wheat and 3,000 lbs. of straw from each acre. Silica and potash are especially needed by wheat, and so it grows well on stiff clays which contain much silica. Wheat has never been found growing wild in any part of the world. It was cultivated in Britain in the time of the Romans. It is now chiefly produced in North America, France, Russia, Germany, Italy, Hungary, and India. The United States is the greatest wheat producer, yielding in some years more than 600,000,000 bushels, while the yield of the whole world in 1899 was 2,725,000,000 bushels.

Wheel. [AS.] A circular frame turning round on an axle. The radii are spokes which are fixed in the nave or hub, through which is inserted the axle.—*Wheel and axle*, one of the six simple machines or mechanical powers, consisting of a wheel fixed to an axle, used for raising weights by a rope. The principle of equilibrium is the same as in the lever, but continuous. The gain in power is in proportion to the size of the circumference of the wheel as compared with that of the axle. If the circumference of the wheel be ten times that of the axle, then one pound attached to the wheel will balance ten pounds applied to the axle.

Whelk. [AS.] A shell-fish with a spiral shell, belonging to the genus *Buccinum*. It is common on the coasts of Europe and North America, and is used for food.

Whey. [AS.] The watery part of milk separated from the curd in making cheese. The greater part of the whey is water; but in this water are dissolved the *milk-sugar* and the *mineral matter* of the milk; the mineral matter is chiefly *phosphate of lime*. In 100 lbs. of cow's milk there are 92 lbs. of whey, consisting of—water, 86 lbs.; milk-sugar, 5 lbs.; mineral matter, 1 lb.

Whippoor-will. A North American bird of the Goatsucker or Nightjar family. It takes its name from its loud and plaintive nocturnal cry. Some regard it as a bird of ill omen.

Whirl′pool. A body of water whirling in a circle, and drawing into its centre whatever enters its waters. Whirlpools are situated in channels similar in configuration and in tidal phenomena. Charybdis is in the Straits of Messina. Maelstrom is on the north-west coast of Norway. Corrievrekin is in Jura Sound, Scotland. The Niagara whirlpool is really a large eddy in which whirlpools are constantly forming.

Whiskey. [Celt. *wisge*, water.] Spirit distilled from grain, potatoes, etc. Scotch or malt whiskey has the malt dried over a peat fire; Irish or grain whiskey is made from raw barley.

Whist. [From *hush.*] A game of cards for four, in which each person holds thirteen cards, and when these are played out the cards are shuffled and again given out. In short whist five points make the game, and two games a rubber.

White′bait. A small fish of the Herring kind, prized for food. It is supposed to be the fry of both herrings and sprats, the proportion of the latter being greater in winter, while the herrings are more numerous in the summer. Thames whitebait possibly find more suitable food there, and may be superior in condition and flavor.

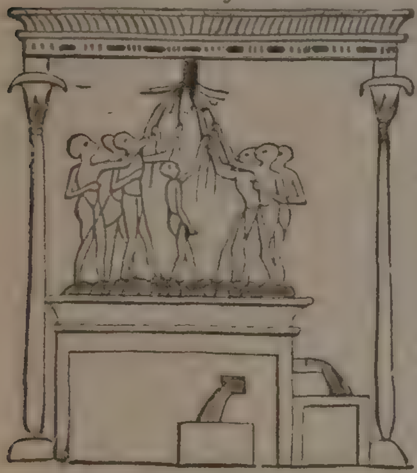
Whor′tleberry. [Cor. of *myrtillus.*] A plant which grows abundantly in heaths and woods, and bears evergreen leaves, and a blue berry which may be eaten; also the bilberry, and in America the huckleberry. The cowberry has red fruit. The cranberry is closely allied to the whortleberry.

Wil′low. [AS.] A tree whose branches are slender and easily bent, used for basket making and wicker-work. The *Weeping* willow is a very ornamental species of Chinese origin, and has long slender branches that hang down almost perpendicularly. The *Pollard* willow is one with its trunk cut back to throw out fresh and numerous osiers. The *White* willow, the largest species known in Britain, and the *crack* willow, are used in making charcoal. Willows occur in temperate and moist climates, but they have not been found in Australia or the South Sea islands.

Win′cey. A cloth made of linen and wool mixed. Also called linsey-woolsey.

Winds. Currents of air having their origin in the different pressures which exist in various regions of the atmosphere. Since the sun is shining more powerfully upon the equatorial than upon the more northern regions of the globe, the heated and therefore rarefied air ascends, while a current of colder air flows in from the poles on both sides to take the place of the ascending air. The ascending column of air flows over from the equator towards both poles, so that the general atmospheric circulation consists of an under current from the north and south poles towards the equator, and of an upper current from the equator towards both poles. This general circulation proceeds in spite of other circulations on a smaller scale or of a local character which may be going on at the same time. North-east and south-east trades occur in the northern and in the southern hemisphere. (See *Weather* and *Trade Winds.*)

Wine. [AS., from L. *vinum.*] A drink made from the sweet juices of fruits, which are pressed out, allowed to ferment, and then bottled. Grapes are chiefly used for wine-making. *Sherry* and *port* are made in Spain and Portugal. *Claret* is a light, rather acid kind of wine, made in France; from which country we also get *champagne*, a wine which contains much carbonic acid gas. The wines of Southern Europe excel in body and strength, but lack the aroma of Rhine wines. Large quantities of wine are now produced in the United States, especially in California. On an average, 100 lbs. of wine contains from 10 lbs. to 15 lbs. of alcohol. When wine is heated in a closed vessel, the alcohol rises out of it as vapor. If the vapor be then made to pass through a tube surrounded by cold water, it will be condensed to brandy.



ANCIENT EGYPTIAN WINE PRESS.

Wing. [Scand.] The appendage of the body of a bird or insect, by means of which it flies. The framework of the bird's wing is formed of a set of bones corresponding to those of the human arm and hand, but having only one perfect finger, corresponding to the index finger; and stretched over this framework is a thin covering of flesh and muscle from which grow the quills and smaller feathers, and these when spread out make up the broad wing. The upper surface is rounded, and the air can easily slide from its edges as it mounts in the air. Bats are the only mammals which fly, and their wings are arms and fingers lengthened out, and supporting a skin spread out like the cover of an umbrella on its ribs. There are other mammals, like the flying squirrel, the flying lemur, etc., which have a partial power of flight. The wings of insects are thin, often transparent, membranes. Some insects use them for only a brief period of their lives; the ants, after their marriage flight, cast off their wings and live without them afterwards. Some, as the flies, have two wings, but most insects have four.

Witch. A woman supposed to have a compact with the devil or with evil spirits, and given the power to perform supernatural acts. A man with similar power is called a *wizard.* Supposed witches have been persecuted from the times of Moses downward until about a century ago, and great numbers of persons have been put to death on accusation of witchcraft.

Win′tergreen. A common American plant, about 4 or 5 inches high, with small whitish flowers and red berries. It is also known as partridge-berry, checker-berry, mountain tea, and by other names. The plant has a pleasant aromatic taste and odor, and yields the *oil of wintergreen*, used as a stimulant, for flavoring syrups, and in perfumery.

Wireless Telegraphy. A newly invented method of sending electric telegraph messages without the aid of wires. The best-known invention is that of Marconi, an Italian electrician, the message being sent by the use of a powerful current of high frequency, which passes through the ether or the earth and acts on a suitable receiving instrument many miles distant. The distance to which messages can be sent is annually increasing.

Wolf. [AS.] A carnivorous animal of the Dog family. It is very cruel, fierce, and destructive, but is capable of great affection. In many respects it is like a neglected savage dog. It does not bark, but gives a hoarse howl; nor does it lap like the dog, but drinks by sucking. There are many kinds, varied in size, thickness of fur, and in color. The ordinary color is a yellowish gray, but there are also black, brown, and white wolves. They are found in Europe, Asia, and North America, but not in South America or Africa. Wolves do not lie in ambush, but run down their prey in open chase, their favorite prey being the allied species of the domestic dog and the Arctic fox. The coyote or American prairie wolf and the Japanese wolf are smaller species than the ordinary wolf or *Canis lupus.*

Wood. [AS.] The solid part of trees; trees cut down and sawn into boards. The wood used in the construction of houses is chiefly obtained from pine and from fir trees, the wood of both being called pine-wood. When sawn into boards it is known as deal; when split into thin narrow strips, it forms laths. The wood should be seasoned or thoroughly dried by exposure to the air for one or two years after the tree has been cut down. For making furniture, hard woods, such as oak, maple, cedar, ebony, walnut, mahogany, and rosewood, are used. The two latter are often cut into very thin slices, called *veneers*, which are then glued on the surface of beech or some other cheap wood and made into furniture. Besides its importance in building and the manufacture of furniture, wood is necessary as fuel, and is greatly used in countries covered with forests where coal is not easily obtained. The toughest wood is pig-nut hickory; next, white oak and white ash. (See *Lumbering*.)

Wood′bine. [AS.] A climbing plant with sweet-smelling flowers; the honeysuckle.

Wood′chuck or **Ground-hog.** An American species of the Marmots, a genus of rodents. This animal, from 15 to 18 inches long, burrows in the earth, and often commits great havoc in fields of clover, of which it is very fond. The *prairie-dog* is allied to the marmots.

Wood′cock. A bird allied to the snipe, frequenting woods, and considered as game. It is nocturnal in its habits. The little woodcock is the snipe.

Wood′pecker. A bird having a hard pointed bill for pecking holes in trees, and a long tongue for drawing out insects from holes or crevices. This tongue is armed near the end with sharp barbs, pointed backward like a fish-hook. The tongue is fastened to cartilages which extend up to behind the skull and over the forehead, and in consequence of this it can be thrust out some distance beyond the beak. Apple and maple trees are sometimes pierced by the woodpecker's holes in rings one above the other, just as farmers pierce the maple. The nest is lodged in a pear-shaped hole made in a tree-trunk, much larger than the circular entrance at the top.

Wood-pulp. A fibrous material prepared from wood by grinding or by chemical means, and used, soaked in water, for making printing and other paper, and for various small wares, such as plates, basins, and pails. It has been used as a filling for car-wheels, in making bricks and tiles, etc., and even for making an imitation silk thread.

Wool. [AS.] The natural covering of certain animals, the best known of which is the sheep. The sheep is a tame or domestic animal, but in certain countries, as Asia, North America, and in parts of Europe (Sardinia and Corsica), wild sheep still abound. The entire coat of wool growing on any one sheep is called its fleece. This fleece is usually cut off or shorn once a year. The countries producing most wool are England, Australia, Cape Colony, Saxony, Spain, United States, and Mexico. Wool is remarkable for its softness, and the wavy nature of the separate fibres. When the fibres are drawn through the fingers in one direction, they feel smooth; but in the opposite direction they are rough, and seem to catch. The wool, being cut and carefully prepared, is spun into yarn by a machine which twists the fibres together, so as to form them into a long thread; the waviness of the fibres and the projecting scales help them to hold firmly together. The yarn is then woven into cloth. Any piece of woolen stuff consists of two sets of threads—one set called the warp, running the long way of the piece; and another set called the weft, running across, and interlacing with the warp. Lastly, the woolen cloth, as we may now call it, is dyed and pressed, the nap is raised by a process called teaseling, and the material is then ready to be made into clothes. When wool is spread out in a thin layer, well moistened, and then beaten smartly with a rod, the fibres become matted together, and form a material called *felt*, of which hats, carpets, etc., are made. Wool is a bad conductor of heat, and so prevents its escape from the body. At the same time wool is a good absorber of moisture, soaking up the perspiration as soon as it comes out of the skin. Owing to the roughness of the fibres, woolen materials gently chafe or rub the skin, and so promote its healthy action.

Worm. [AS. *wyrm*, a worm or snake.] Earthworms are humble animals, yet they are valuable aids to the agriculturist. On making a section down through the earth for several feet, there will be found innumerable tunnels formed by worms. A naturalist considers that they average 100,000 to the acre, and in especially rich ground in New Zealand it was estimated that there were 348,840 in a single acre. This vast body of worms is continually at work boring this way and that, coming to the surface during the night and retreating to greater depths during the day; and their tunnels constitute a system of irrigation and ventilation. Rain, instead of running off, enters the holes, and so penetrates the earth, thus being held for a longer time. Air also finds its way below the surface. But this is a very small part of the work accomplished. Worms are continually swallowing the earth and depositing it at the surface, and working it over and over. Darwin states that the vegetable mold thus transported in some places amounts to ten tons an acre. Worms not only carry all the material to the surface, but they drag vast quantities of leaves and other matter down that serve to enrich the soil and render it capable of producing larger crops. Some worms are a foot in length. Their bodies are formed of a large number of rings. On each ring there are a great many bristles. Grubs move forward by means of their tiny feet, snakes by means of their scales, and worms by means of their bristles. Their bodies are very elastic. The worm pushes forward its head, the bristles in the front part of its body take hold of the ground, and the rest of the body is then pulled along. In addition to the earth-worms, the name worm is applied to a large variety of elongated water animals, very many of them dwelling in the ocean, also to numerous internal parasites, some of which dwell in the human body. (See *Tape*.)

Worst′ed. [From Worsted or Worstead, a village in Norfolk.] Wool twisted into thread used for knitting stockings. Long yarn is made by drawing, gilling, and combing. Short wools are first carded and afterwards combed. Worsted for carpet-yarns or knitting-yarns is carded only.

Wort. [AS.] A plant of the Cabbage kind; also the sweet liquor obtained by steeping crushed grain in hot water, which ferments and forms beer (*q.v.*).

Wren. [AS.] A small brown bird having active and lively habits. It has a domed nest needlessly large for the size of the bird, and near an occupied nest are generally one or more nests unfinished. It is extensively found in Europe, and inhabits Palestine. The winter wren and house wren are common in North America. In Britain there are the wood wren and willow wren; also the chiff-chaff, which, from its nest, is sometimes called "oven" bird. Wrens, like robin redbreasts, whistle all the year round, times of hard frost excepted.

Y

Yacht. [Du.] A swift, light boat fitted up for pleasure-sailing or for racing. Yacht-racing dates from the beginning of the nineteenth century, during which it was greatly developed. Important international yacht races took place between England and the United States, in nearly all of which the latter was victorious.

Yak. [Tibetan.] A large ox, very sure-footed, found in the plains of Central Asia. It is like the long-horned Scottish cattle, but more strongly built. In color it is black, and it has long hair, especially at the hind quarters, where it touches the ground. The wild yak is found always just under the snow-line; the tame yak is seldom employed below 12,000 feet above sea-level. The tails of domestic yaks are employed in India as fly-flaps.

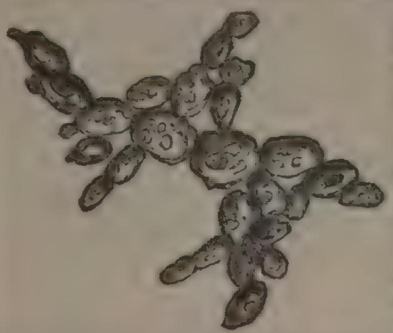
Yam. A large plant, with roots somewhat like the potato, grown in warm countries. The clusters of flowers are separately small, but together are showy. Most yams contain an acrid matter which is lost in cooking. The true yam is sometimes confused with the sweet potato, which is convolvulus.

Yarn. [AS.] The fibre of cotton, flax, hemp, silk, or wool spun into threads. Throughout all the changes of modern yarn-spinning, the rotating spindle continues to be the chief implement.

Yawl. [Du.] A small ship's boat rowed with four or six oars.

Year. [AS.] The time which the earth takes to go round the sun. The *tropical year* is the interval between two successive passages of the sun through the first point of Aries. Its mean length is 365 days 5 hrs. 48 min. 49.7 sec. Owing to the precession of the equinoxes it is shorter than the *sidereal year*, which is the interval which elapses between the time of the earth's leaving a given point in its orbit and the time of its returning to it. It consists of 365 days 6 hrs. 9 min. 9.6 sec. The order of the seasons is determined by the tropical year. The year is accounted 365 days in length, except every fourth year, which is named *leap year* and has 366 days. As this would make the average year rather too long, the last year of the century is not leap year unless its unit number can be divided by four. Thus 1900 was not leap year, but 2000 will be.

Yeast. [AS.] The froth that rises on the top of liquors in the process of fermentation; or the substance used for raising dough to be baked into bread (*q. v.*). Although yeast looks like a liquid to the naked eye, yet under the microscope a drop of yeast is found to contain thousands of extremely small rounded bodies, which are tiny plants of the Fungus kind. The yeast-plant feeds on part of the *starch* in the flour, and the result is that this starch is changed into grape-sugar. Leaven is only a little flour and water which has been left exposed to the air until some of the "spores" or "seeds" of the yeast-plant (which are always floating about in the air) have settled in it and begun to grow, which they do with wonderful rapidity.



YEAST FUNGUS, MAGNIFIED 400 TIMES.

Yellow Bird. This bird is known as the American Gold-finch or Thistle-bird. It is generally distributed over North America. The male is bright yellow, with black tail and wings marked with white and with black on top of the head; the female is yellowish brown above and darker brown below. They are usually seen in flocks, feeding on the seeds of thistles, sunflowers and other plants.

Yel'low-hammer. A British song-bird with yellow feathers. This bird breeds late, and continues to sing until late in the year.

Yew. [AS.] An evergreen tree like the pine, used either in hedges or separately. Its wood is hard and close-grained, and its young branches, owing to their toughness, were formerly much used for bows. Old yews are common near churches. The leaves have poisonous properties.

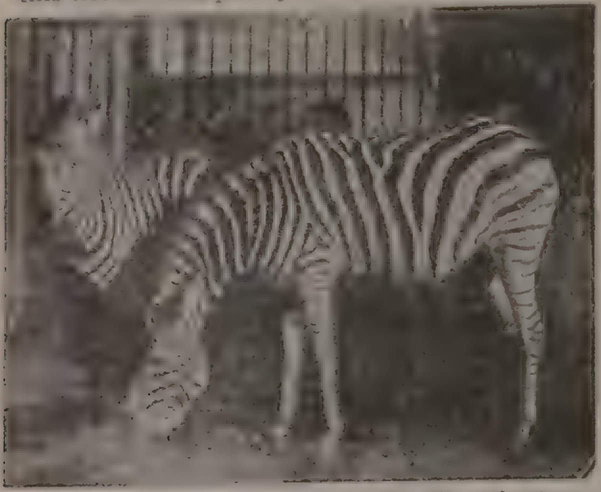
Yolk or **Yelk.** [AS.] The yellow part of an egg. It has a thin skin around it, and has in it a little jelly-like germ, from which the young bird develops. (See *Egg.*)

Yuc'ca. [Span.] A kind of lily peculiar to North America. Some kinds have underground stems and dagger-like leaves; others have palm-like stems crowned with dense tufts of leaves. They yield coarse fibres used for ropes and cloth, and are grown as ornamental plants. The plant is popularly called "Adam's Needle."

Yule. [AS.] The old English word for Christmas, still used in provincial parts of England. The bringing in of the *Yule log*, for burning on the Christmas hearths, was a festive ceremony.

Z

Ze'bra. [Port.] A kind of wild ass, of the genus *Equus*, perhaps the most beautiful animal of this tribe. It is pale yellow or white in color, with black or brown stripes. It lives in large herds in the mountainous parts of Africa, and is very wild. Few zebras have ever been tamed.



Ze'bu. [Fr.] A variety of the Ox family with short horns, long ears, and a large hump over the shoulders, found in India and the Asiatic islands, and along the east coast of Africa. Some are of large size and others as small as a sheep.

Ze'nith. [Fr., from Arab.] The point in the celestial sphere which a person standing on the earth at any point sees directly overhead; directly opposite to the *nadir*.

Zinc. A metal of a bluish-white color, having a crystalline structure. It is brittle at ordinary temperatures, but when heated it becomes malleable, and does not lose this quality when cooled. If raised to a red heat in a closed vessel, it will boil and pass off in vapor, and when heated in the air it burns with a bright flame. When exposed to damp air, a thin coating of rust is formed, which prevents the further oxidation of the metal. Combined with copper, it forms the alloy brass, and it also forms an ingredient in German silver. In the metallic state it is used for roofing, for rain-pipes, for gutters, and as a coating for sheet-iron and iron wire. Iron covered with zinc in this way is known as *galvanized* iron. Zinc is also used in some electric batteries; and as an oxide it is employed as a pigment.

Zo'diac. A broad belt running round the heavens parallel to the ecliptic, and extending about 8° on each side of it. It is the area within which the motions of the sun, moon, and the greater planets lie. The stars in the zodiac have been divided into twelve groups called constellations—Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, Pisces. These divisions do not now coincide with the constellations as formerly; for by the precession of the equinoxes they have been moved back about 25° behind the constellations.

Zodiacal Light. A remarkable luminous appearance in the sky, seen in the west after sunset, and in the east before sunrise, at certain seasons of the year. It is a triangle of light, of greatest intensity within the tropics, where its brilliancy sometimes rivals that of the Milky Way. It stretches through the sky nearly in the direction of the sun's equator. It is only during the spring and autumn that in our latitudes it can attain sufficient height in the sky to be distinguishable.

ABBREVIATIONS.

The following are the most common abbreviations used in this book:

Arab. or Ar.	*Arabic.*
AS.	*Anglo Saxon.*
Braz.	*Brazilian.*
Celt.	*Celtic.*
Chin.	*Chinese.*
Cor.	*Corresponding.*
Dan.	*Danish.*
Du.	*Dutch.*
Fr.	*French.*
G.	*German.*
Gk.	*Greek.*
Goth:	*Gothic.*
H	*Hayti.*
Heb.	*Hebrew.*
Hind.	*Hindu.*
Icel.	*Icelandic.*
Ital.	*Italian.*
L.	*Latin.*
L. Lat.	*Low Latin.*
Malay	*Malayan.*
O. E.	*Old English.*
O. F.	*Old French.*
Pers.	*Persian.*
Pl.	*Plural.*
Port.	*Portuguese.*
q. v.	*which see.*
Sax.	*Saxon.*
Scand.	*Scandinavian*
Sing.	*Singular.*
Sp. or Span.	*Spanish.*
Swed.	*Swedish.*
Turk.	*Turkish.*
W. Ind.	*West Indies.*

BOOK II.

EVERY-DAY HISTORICAL DICTIONARY

THE WORLD'S GREAT MEN AND WOMEN AND WHAT SHOULD BE REMEMBERED OF EACH—ALPHABETICALLY ARRANGED—A BOOK OF UNTOLD VALUE FOR LEARNING THE RIGHT THING ABOUT THE RIGHT PERSON—A THOUSAND WORTHIES OF ALL TIMES AND ALL COUNTRIES.

GREAT MEN AND GREAT WOMEN OF ALL TIMES

FAMOUS MEN AND WOMEN

A DICTIONARY OF DISTINGUISHED PEOPLE OF THE WORLD—EMBRACING THEIR NATIONALITY, VOCATION, GREATEST ACHIEVEMENTS, AND DATES OF BIRTH AND DEATH.

Abbott, J. S. C. American historian. *Life of Napoleon Bonaparte; History of Russia.* Born, 1805; died, 1877.

Abbott, Emma. A noted American singer and prima donna. Mrs. E. J. Wetherell. Born, 1849; died, 1891.

Abbott, Lyman. American clergyman and author; succeeded Beecher as pastor of Plymouth Church; editor *Outlook*. Born, 1835.

Adams, John. American President and diplomatist, graduated at Harvard; school-teacher and lawyer; defended British soldiers implicated in Boston Massacre, 1770; delegate to Continental Congress, 1774; commissioner to France, 1778; minister to Holland, 1781; one of the negotiators of treaty of peace with Great Britain, 1782; minister to Great Britain, 1785–88; Vice-President, 1789–97; President, 1797–1801. Born, 1735; died, 1826.

Adams, John Quincy (son of John). American President and diplomatist, graduated at Harvard; minister to Holland, 1794; to Prussia, 1797; elected to U. S. Senate by Federalists, 1803; resigned, 1808; minister to Russia, 1809; one of the negotiators of the treaty of peace with Great Britain, 1814; minister to England, 1816–17; Secretary of State, 1817–1825; President, 1825–29; M. C., 1830 till his death. Born, 1767; died, 1848.

Adams, Samuel. American Revolutionary patriot and statesman; Governor of Massachusetts; one of the foremost popular leaders of the Revolution. Born, 1722; died, 1803.

Addison, Joseph. English man of letters, poet, humorist, moralist, dramatist; Under-Secretary of State, 1705; M. P., 1708. His poem *The Campaign*, on the battle of Blenheim, had a great success. Much of the *Tatler* (edited by Steele) and three-fourths of the *Spectator* are his. Born, 1672; died, 1719.

Æschines. Athenian orator; rival of Demosthenes, and supporter of Philip of Macedonia. *Orations.* Born, B. C. 389; died, 314.

Æschylus. Sublime Athenian tragic writer. *Agamemnon the Persian.* Born, B. C. 525; died, 456.

Æsop. Greek fabulist of the 6th century B. C. *Fables.*

Agassiz, Louis. Swiss naturalist and man of science, Professor at Harvard; founder of the Museum of Comparative Zoology at Cambridge, Mass. *Researches on Fossil Fishes.* Born, 1807; died, 1873.

Agricola, Cnæus Julius. Roman general; built line of fortresses across Scotland; father-in-law of the historian Tacitus. Born, 37; died, 93.

Agrippina. Mother of the Emperor Nero, infamously cruel and sensual; put to death by Nero. Born, 15; died, 60.

Aguinaldo, Emile. A Philippine soldier and statesman; leader of the revolt against Spain and the war against the United States; captured and took oath of allegiance to the United States in 1901. Born, 1869.

Alaric I. King of the Visigoths, captured Rome. Born, 350; died, 410.

Albert, Prince Consort of England; husband of Queen Victoria; man of noble character. Born, 1819; died, 1861.

Alcibiades. Athenian statesman and commander. Led Athenian fleet; conquered at Cyzicus and Cynossema; annexed Chalcedon and Byzantium. Handsome, talented, fickle, vain. Born, 450; died, 404.

Alcott, Louisa M. American author. *Little Women; An Old Fashioned Girl; Hospital Sketches.* Born, 1833; died, 1888.

Aldrich, Thomas Bailey. American novelist and poet. *Prudence Palfrey; The Story of a Bad Boy.* Born, 1836; died, 1907.

Alexander the Great, King of Macedonia, conqueror. Aristotle was his tutor. He came to the throne in 336, razed Thebes, and was chosen by the Greeks commander of the forces against Persia; invaded Asia Minor (334), beat Darius at the Granicus, and cut the Gordian knot; defeated Darius at Issus (333); captured Tyre (332), invaded Egypt and founded Alexandria; routed Darius at Arbela (331); took Babylon, Persepolis, Susa, and invaded India till his army refused to proceed farther; died at Babylon. Born, B. C. 356; died, 323.

Alexander VI. (Borgia.) Pope 1492–1503. Infamous for his crimes. Born, 1430; died, 1503.

Alexander I. Czar of Russia (1801–25); one of the chief opponents of Napoleon, reorganized Russian army. Born, 1777; died, 1825.

Alexander II. Czar of Russia (1855–81); liberator of the serfs. Assassinated. Born, 1818; died, 1881.

Alexander III. Czar of Russia (1881-94.) Born, 1845; died, 1894.

Alfieri. An Italian dramatist. Spent his youth in dissipation; reformed and devoted himself to dramatic art. "Cleopatra" was his first successful drama. Tragedy was his *forte*. Buried at Florence. Born, 1749; died, 1803.

Alfred the Great. King of Wessex. Came to throne 871; lived in concealment to escape Danes; routed Danes, 878; allowed them to settle in his kingdom; repelled invasion of the Northmen, 896; founded a navy; established schools and a police system; encouraged literature. Born, 849; died, 901.

Allen, Ethan. American Revolutionary soldier; captured Ticonderoga "in the name of the great Jehovah and the Continental Congress." Born, 1737; died, 1789.

Alva, Duke of. Noted Spanish general during reign of Charles V. and Philip; Governor of the Low Countries; noted for his merciless cruelty. Born, 1508; died, 1582.

Ames, Fisher. American orator and statesman; Federalist member of Congress. *Speeches.* Born, 1758; died, 1808.

Amurath I. Sultan of Turkey; first of the Sultans to make European conquests. Born, 1319; died, 1389.

Andersen, Hans Christian. Danish author. *Fairy Tales for Children; The Improvisatore; The Poets' Bazaar.* Born, 1805; died, 1875.

Andre, Major John. English soldier in the American Revolution, hanged as a spy. Born, 1731; died, 1780.

Anne. Daughter of James II. Queen of England. Literature flourished in her reign. Born, 1664; died, 1714.

Antiochus. King of Syria. "The Great;" invaded Greece; defeated by the Romans. Born, B. C. 237; died, 187.

Antoinette, Marie. Queen of Louis XVI. of France. Guillotined. Born, 1755; died, 1793.

Antonius, Marcus (Mark Antony). Roman orator and statesman; triumvir with Octavianus and Lepidus. Lover of Cleopatra; defeated at Actium. Born, B. C. 83; died, 36.

Appius Claudius. Roman patrician. Decemvir; attempted to dishonor Virginia, daughter of Virginius. Died, B. C. 449.

Aquinas, Thomas. Scholastic Italian theologian. Author of *Summa Theologia*, to this day a standard authority in the Roman Catholic Church. His writings fill 17 folio volumes. While a member of the Council of Lyons, fell sick and died at that city. Born, 1226; died, 1274.

Archimedes. Syracusan mathematician and engineer; made many discoveries in hydrostatics and mechanics. *On the Sphere and Cylinder.* Born, B. C. 287; died, 212.

Aristides. "The Just." Athenian statesman. Rival of Themistocles. Died, B.C. 468.

Aristophanes. Greatest Greek comedy writer. *The Knights. The Clouds. The Birds.* Born, B. C. 444; died, 380.

Aristotle. Greek philosopher. Father of scientific natural history, and of logic. Tutor of Alexander the Great; taught at Athens in the Lyceum; left works on physics, metaphysics, ethics, dialectics, logic, mathematics, politics, economics. Born, B. C. 384; died, 322.

Arius. A noted Catholic theologian, a presbyter of Alexandria in the 4th century. Founder of Arian sect. Born, 280; poisoned, 336.

Arkwright, Sir Richard. Noted English inventor. Began life as a barber. Invented the spinning frame. Was mobbed because his machine threatened to interfere with labor. "This man," says Carlyle, "gave to England the power of cotton." Became very wealthy. Born, 1732; died, 1792.

Arminius, James. Dutch theologian; founder of Arminianism; denied Calvinistic doctrines of grace and predestination. Born, 1560; died, 1609.

Arnold, Benedict. American traitor. Tried to surrender West Point to the British. Born, 1740; died, 1801.

Arnold, Edwin. English journalist and poet, editor of the London *Telegraph. The Light of Asia; Light of the World.* Born, 1832.

Arnold, Matthew. English poet and critic. *God and the Bible; Poems; Essays in Criticism.* Born, 1822; died, 1888.

Arnold, Thomas. English educator and historian. Master of Rugby School. *History of Rome.* Born, 1795; died, 1842.

Arthur, Chester A. American President; born in Vermont and educated at Union College; admitted to the bar; Quartermaster-General of New York during the Civil War; Collector of the P
of New York, 1871–78; Vice-President, 188
succeeded to Presidency on death of Preside
Garfield, September, 1881. Born, 1830; died, 188

Ascham, Roger. Tutor of Queen Elizabeth. *The Schoolmaster; Toxophilus or the School of Shooting.* Born, 1515; died, 1568.

Astor, John Jacob. American millionaire; founder of the present Astor family. Born, 1763; died, 1848.

Attila. "The Scourge of God." King of the Huns. Invaded the Roman Empire. Died, 453.

Audubon, John James. American naturalist. *Birds of America.* Born, 1782; died, 1831.

Augustine, Saint. Bishop of Hippo in Africa. Theologian, *De Civitate Dei.* Professor of rhetoric and philosophy at Milan, 384; was for a time immoral, but was converted about 386. Ordained priest 391. He wrote against the Pelagians, the treatises *On the Grace of Christ*, and *On Original Sin.* Born, 354; died, 430.

Augustus (Octavianus). First Roman Emperor. Conqueror at Actium, Patron of literature. Born, B. C. 65; died, A. D. 14.

Aurelian. Roman Emperor. Conquered Zenobia and annexed her kingdom of Palmyra. Born, 212; died, 275.

Austen, Jane. English novelist. *Sense and Sensibility; Pride and Prejudice; Emma.* Born, 1775; died, 1817.

Bach, John Sebastian. German composer. *The Nativity.* Produced both secular and sacred music in great variety. Born, 1685; died, 1750.

Bacon, Francis, Viscount St. Albans, Lord Verulam. English statesman and philosopher. *Novum Organum; Advancement of Learning.* Counsel to Queen Elizabeth at 28; found guilty of corruption, 1621. Among his works are *Essays;* and *On the Wisdom of the Ancients.* His *Novum Organum* applies inductive method to study of science. Born, 1561; died, 1626.

Baker, Sir Samuel White. Noted English traveler in Africa and India. Wrote five books of travels. Born, 1821; died, 1893.

Balboa, Vasco Nuñez de. Spanish adventurer. Discoverer of the Pacific. Born, 1475; died, 1517.

Baltimore, Lord George Calvert. English statesman. Founder of Maryland. City of Baltimore named for him. Born, 1580; died, 1632.

Balzac, Honoré de. French novelist. *Comedie Humaine.* Born, 1799; died, 1850.

Bancroft, George. American diplomatist and historian. Minister to England, and to Germany; Secretary of the Navy. *History of United States.* Born, 1800; died, 1891.

Barneveldt, Jan van Olden. Dutch statesman, patriot, liberal leader. Beheaded. Born, 1549; died, 1619.

Barnum, Phineas T. American showman. Born, 1810; died, 1891.

Baxter, Richard. English Dissenting minister, writer. *The Saints' Rest.* Born, 1615; died, 1691.

Beauharnais, Alexander, Vicomte de. First husband of the Empress Josephine. Born, 1760; died, 1794.

Becket, Thomas à. Archbishop of Canterbury. Murdered; had controversy in defence of rights of the Church with Henry II. of England, whom he excommunicated. Born, 1117; died, 1170.

Bede, "The Venerable." Anglo-Saxon historian. *Ecclesiastical History of the English Nation.* Born, 672; died, 735.

Beecher, Lyman. American Congregational preacher, and theologian. *Views on Theology.* Born, 1775; died, 1836.

Beecher, Henry Ward. American preacher, lecturer, and orator, at Brooklyn, N. Y. *Star Papers.* Born, 1813; died, 1887.

Beethoven, Louis von. German composer. *Ninth Symphony.* For a time organist to the Elector of Cologne; settled in Vienna, where he produced (1802) his *Sinfonia Eroica.* In 1805 appeared his opera of *Lenore.* He composed many symphonies, cantatas, and overtures. Born, 1770; died, 1827.

Bell, A. G. American inventor. Inventor of the Bell telephone. Born, 1847.

Bennett, James Gordon. American journalist. Proprietor of the *N. Y. Herald.* Born, 1795; died, 1872.

Berlichingen, Goetz von ("The Iron-Handed"). German hero. Immortalized by Goethe. Slain in war of peasants against nobles. Born, 1480; died, 1562.

Bernard, Saint. Abbot of Clairvaux. French ecclesiastic. Born at Dijon, in Burgundy. He was active in bringing about the crusade of 1146; canonized in 1174. Born, 1091; died, 1153.

Bernhardt, Sarah. The most noted French actress of modern times, if, indeed, she may not be called the most famous actress of all time. She traveled over the countries of Europe and America a number of times, always rendering her plays in the French language, yet commanding higher prices than any other person on the stage, the popular prices for choice seats in 1900–1901 in New York and Philadelphia being $10 to $25. Born, 1844.

Besant, Sir Walter. English novelist. Eminent chiefly for the healthy realistic type of his work. Champion of the cause of Authors versus Publishers. Born, 1838; died, 1901.

Bismarck, Otto von. German statesman; 1847, member United Diet and leader of Conservatives; ambassador to Russia, 1809; Prime Minister of Prussia, 1862; Chancellor of the German Empire. Born, 1813; died, 1898.

Black, William. Scotch novelist; originally a journalist. *A Daughter of Heth; Strange Adventures of a Phaeton; A Princess of Thule; Madcap Violet.* Born, 1841; died, 1899.

Black Hawk. Indian chief. Hero of the Black Hawk War. Born, 1768; died, 1838.

Blackstone, Sir William. English judge, and law writer. *Commentaries.* Born, 1723; died, 1780.

Blaine, James Gillespie. American Republican politician; U. S. Senator from Maine; Speaker, House Representatives; Secretary of State. Born, 1830; died, 1893.

Blake, Robert. Great English admiral and sea king. Annihilated Spanish fleet in Santa Cruz Bay. Born, 1598; died, 1657.

Blücher, Gebhard L. von. Prussian field marshal; decided the battle of Waterloo by coming with his force in the evening. Born, 1742; died, 1819.

Boleyn, Anne. 2d Queen of Henry VIII. Beheaded. Born, 1507; died, 1536.

Bolivar, Simon. Liberator of the Spanish South American colonies. Born, 1783; died, 1830.

Bonaparte, Caroline M. A. Sister of Napoleon I. Wife of Murat. Born, 1782; died, 1839.

Bonaparte, Jerome, born, 1784; died, 1860. Joseph, born, 1766; died, 1844. Louis Napoleon, born, 1778; died, 1846. Brothers of Napoleon. Kings respectively of Westphalia, Spain, Holland.

Bonaparte, Maria Letitia. Mother of Napoleon I. Born, 1750; died, 1836.

Bonaparte, Napoleon. Napoleon I. Emperor of France. Captain of Artillery, 1792; crushed insurrection in Paris, 1795; married Josephine Beauharnais, and took command of the army of Italy, 1796; conquered Austria and the Pope, 1797; made an expedition to Egypt, 1798; made First Consul, 1799; conquered at Marengo, 1800; made peace with England, 1802, and about this time produced his *Civil Code.* Became Emperor, 1804; engaged in war with England, Russia, Sweden, Prussia; married Marie Louise, 1810; made a disastrous campaign in Russia, 1812; was beaten at Leipzig, 1813; retired to Elba, 1814; returned to France, and was conquered at Waterloo, and sent to St. Helena, 1815. Born, 1769; died, 1821.

Bonheur, Rosa. Celebrated French painter of animals. Born at Bordeaux. Brought up in poverty. Taught by her father. Best known works "The Horse Fair" and "Hay Harvest in Auvergne." "Ploughing with Oxen" is her masterpiece. Born, 1822; died, 1900.

Boniface VIII. Pope; 1294–1303. Excommunicated Philip the Fair of France. Born, 1228; died, 1303.

Boone, Daniel. American explorer and hunter. Father of the present State of Kentucky. Born, 1735; died, 1820.

Booth, Edwin. American actor. Among his best parts are *Richelieu*, *Iago*, *Hamlet*, and *Berbuccio* in the *Fool's Revenge*. Born, 1833; died, 1893.

Booth, Junius Brutus. English tragedian. Great in Shakespearean parts, especially *Richard III.*; came to America. Father of Edwin and John Wilkes. Born, 1796; died, 1852.

Booth, William. Great English evangelist. Founder and general of the Salvation Army. Born, 1839.

Borgia, Cæsar. Italian soldier and statesman. Just as a ruler in his own domain, but crafty and cruel personally. A patron of art and literature. Son of Pope AlexanderVI. Born, 1476; died, 1507.

Boswell, James. Scotch biographer of Dr. Johnson. *Boswell's Life of Johnson*. Born, 1740; died, 1795.

Bowdoin, James. American statesman. Governor of Massachusetts. Founder of Bowdoin College. Born, 1727; died, 1790.

Braddock, Edward. British general in America. Defeated by Indians. Born, 1715; died, 1755.

Breckenridge, John C. American politician. Vice-President (1857–1861). Confederate general. A Democratic candidate for President, 1860. Born, 1821; died, 1875.

Bright, John. English Radical, statesman, and orator. Opponent of Corn Laws; member of Gladstone's cabinet. Born, 1811; died, 1889.

Bronte, Charlotte. "Currer Bell." English novelist; 1848, *Jane Eyre;* 1849, *Shirley;* 1852, *Villette;* 1854, married Rev. Arthur B. Nichols. Born, 1816; died, 1855.

Brown, John. American abolitionist leader. Captured by Robert Lee, at Harper's Ferry, tried and hanged as a conspirator. Born, 1800; died, 1859.

Browne, Charles F. "Artemus Ward." American humorous writer. Born, 1835; died, 1867.

Browning, Mrs. Elizabeth Barrett. English poetess; wrote verses at ten; *The Drama of Exile;* 1844, *Poems;* 1856, *Aurora Leigh;* married Robert Browning in 1846. Born, 1809; died, 1861.

Browning, Robert. English poet. Among his works are *Pippa Passes; The Blood on the 'Scutcheon; The Red-Cotton Night-Cap Country*, and *Idyls*. Born, 1812; died, 1889.

Brownlow, William G. American journalist and politician; Governor of Tennessee; U. S. Senator. Born, 1805; died, 1877.

Bruce, Robert. King of Scotland. Defeated Edward II. at Bannockburn, 1314. Born, 1274; died, 1329.

Brummell, George B. "Beau Brummell." English man of fashion. Born, 1778; died, 1840.

Brutus, Lucius Junius. Roman patriot; overthrew Tarquin and established Republican government at Rome. Flourished 6th century, B. C.

Brutus, Marcus Junius. One of Cæsar's assassins. Defeated at Philippi. Committed suicide. Born, B. C. 85; died, 42.

Bryan, William Jennings. American statesman, born in Salem, Illinois; entered Congress in 1890 as an extreme Free Silver man; was twice nominated for the Presidency in opposition to Mr. McKinley, but defeated in 1896 and again in 1900. Born, 1860.

Bryant, William Cullen. American poet. *Thanatopsis.* Born in Massachusetts; at 13 wrote *The Embargo* and *The Spanish Revolution;* published *The Ages*, 1821; became an editor of the New York *Evening Post* in 1826; *Translation of Homer*, 1867. Born, 1794; died, 1878.

Buchanan, James. American president; born in Pennsylvania; admitted to bar, 1812; M. C., 1821–31; minister to Russia, 1832–4; U. S. Senator, 1834–45; Secretary of State, 1845–9; minister to England, 1852–6; signed Ostend Manifesto, 1854; President, 1857–61. Born, 1791; died, 1868.

Bunyan, John. English author. *Pilgrim's Progress; The Holy City; The Holy War.* For several years led a dissipated, wandering life; joined Anabaptists in 1654; became Baptist minister, 1655; in prison, 1660–72; there wrote part of *Pilgrim's Progress* (1678); after his release, was minister at Bedford. Born, 1628; died, 1688.

Burr, Aaron. American lawyer and statesman; Vice President. Tried for (and acquitted) of treason. Killed Alexander Hamilton in a duel. Born, 1756; died, 1836.

Butler, Benjamin F. American lawyer, politician and general; member of Congress; military governor of New Orleans. Born, 1818; died, 1892.

Byron, George Gordon; Lord. English poet. *Childe Harold, Don Juan; Cain; Manfred; Marino Faliero; The Two Foscari; Beppo; The Vision of Judgment; The Prisoner of Chillon; The Siege of Corinth; Mazeppa; English Bards, and Scotch Reviewers; Parisina; The Deformed Transformed.* Born, 1788; died, 1824.

Cæsar, Caius Julius. Roman general and statesman. Dictator. Quæstor, 58 B.C.; ædile, 65; pontifex maximus, 64; consul, 59 (alliance with Pompey and Crassus called first triumvirate); was granted both the Gauls for 5 years; conquered many tribes, and invaded England; crossed Rubicon and entered Rome; conquered Pompey at Pharsalia (48); subdued Spain and Africa; made imperator; assassinated by Brutus, Cassius, and others. Born, B. C. 99; died, 44.

Cable, George W. American novelist. *Old Creole Days, The Grandissimes, John March, Southerner.* Born, 1844.

Caine, Thomas Henry Hall. English novelist. *The Deemster, The Manxman, The Christian.* Born, 1853.

Calhoun, John Caldwell. American statesman. Vice-President. Native, South Carolina; elected to Congress, 1810; Secretary of War, 1817; Vice-President, 1829-32; resigned in latter year and entered Senate; Secretary of State, 1844; re-entered Senate, 1845; "State's Rights" leader; left, among other writings, a *Treatise on the Nature of Government.* Born, 1783; died, 1850.

Caligula. Emperor of Rome (37-41). Insanely cruel, sensual, impious. Built temple to himself. Born, 12; died, 41.

Calvert, Cecilius. Second Lord Baltimore; was first proprietor of Maryland. Especially distinguished as one of the pioneers of civil and religious liberty. Born, —; died, 1676.

Calvin, John. French theologian. The fundamental doctrines of his theology were unconditional reprobation and election. He published *Commentaries on the Harmony of the Gospel.* Born, 1509; died, 1564.

Campbell, Alexander D. P. Born in Ireland. Founder of the religious sect known as Campbellites, but calling themselves "The Christian Church." Founded Bethany College, Va. Born, 1788; died, 1866.

Camoens, Luis or Luiz. The greatest of Portuguese poets. *The Lusiad* and other poems of rare merit. So neglected and died in such poverty that he has been called *the glory and shame of Portugal.* Born, 1517; died, 1579.

Campbell, Thomas. Scotch poet. Son of a Glasgow merchant. *Pleasures of Hope, Exile of Erin, Ye Mariners of England, Lochiel's Warning.* Born, 1777; died, 1844.

Canning, George. English statesman and orator. Prime Minister; 1807, Secretary for foreign affairs; fought duel with Castlereagh; premier, 1827. Born, 1770; died, 1827.

Canova, Antonio. Italian sculptor. Among his works are *Venus and Adonis, The Graces,* and a *statue of Washington.* Born, 1757; died, 1822.

Canute II. King of Denmark and conqueror of England in 1016. Governed his three kingdoms of Denmark, Norway and England with great firmness and prudence. Born, about 985; died, 1036.

Caprivi, George Leo Graf von. German statesman. In Prussian army 1849–1890. Succeeded Bismarck as chancellor and prime minister in 1890. Born, 1831; died, 1899.

Carleton, Will. American poet. *Farm Ballads.* Born 1845.

Carlyle, Thomas. Scotch historian and essayist. Published *Sartor Resartus,* 1834; *French Revolution,* 1837; *Chartism,* 1839; *Heroes and Hero Worship,* 1840; *Past and Present,* 1843; *Latter Day Pamphlets; Oliver Cromwell's Letters and Speeches,* 1845; *Life of John Sterling,* 1851; *Life of Frederick the Great,* 1858-64. Born, 1795; died, 1881.

Carnegie, Andrew. American manufacturer and capitalist, of Scotch birth. Grew immensely wealthy in the iron and steel business. Withdrew in 1901 with fortune of $250,000,000. Gave many million dollars to found libraries and schools. *Triumphant Democracy.* Born, 1835.

Carnot, Marie Francois Sadi. President of France. Grandson of Lazare Carnot, prominent in the Revolution and Empire. In National Assembly, 1871; finance minister, 1881 and 1887; elected President in 1887; assassinated by an anarchist. Born, 1837; died, 1894.

Castelar, Emilio. Spanish statesman and author. Active in the Cortes; dictator in 1873; withdrew from political life 1893. Wrote historical and political works. Born, 1832.

Carroll, Charles (of Carrollton). American Revolutionary statesman. Signer of the Declaration of Independence. Very wealthy. Born, 1737; died, 1832.

Cartwright, Edmund. English inventor. Parliament voted him 10,000 pounds for inventing the power loom. Born, 1743; died, 1823.

Cass, Lewis. American statesman and diplomatist. U. S. Senator from Michigan. Democratic candidate for President, 1840; Secretary of State. Born, 1782; died, 1866.

Catherine of Aragon. Queen of Henry VIII. of England. Divorced. Born, 1486; died, 1536.

Catherine de Medici. Queen of Henry II. of France. Strenuous opponent of Protestantism and the Huguenots. Instigated the "Massacre of St. Bartholemew." Born, 1519; died, 1589.

Catherine I. Wife of Peter the Great. Empress of Russia; succeeded to government on his death. Born, 1682; died, 1727.

Catherine II. Empress of Russia; often called "The Great." Born, 1729; died, 1796.

Cato, Marcus Portius. Opponent of Cæsar; famed for probity. Committed suicide. Born, B. C. 95; died, 46.

Cavour, Camillo B. Count. Famous Italian statesman. First Prime Minister to the Kingdom of Italy. Born, 1810; died, 1861.

Caxton, William. English scholar and merchant. Distinguished for introducing printing into England. Born, 1412; died, 1492.

Cecil, William, Lord Burleigh. Lord Treasurer of England, under Elizabeth. Born, 1520; died, 1598.

Cervantes Saavedra, Miguel. Spanish novelist and satirist. *Don Quixote.* Born, 1547; died, 1616.

Chalmers, Thomas. Scotch preacher and theologian. Founder of the "Free Church" in Scotland. *Astronomy in its Connection with Religion.* Born, 1780; died 1847.

Chamberlain, Joseph. English Radical statesman; President of the Board of Trade; Colonial Secretary during the Boer War. Born, 1836.

Chambers, Robert. Scottish editor, author, and publisher. With his brother, William, editor of *Chambers' Journal, Chambers' Encyclopedia, Chambers' Book of Days.* Born, 1802; died, 1872.

Chambers, William. Brother, partner, and collaborator with above. Born, 1800; died, 1885.

Channing, William Ellery. American Unitarian theologian and reformer; opponent of slavery. *Self-Culture; The Elevation of the Laboring Classes; Evidences of Christianity.* Born, 1780; died, 1841.

Charlemagne. King of France. Emperor of the West. Son of Pepin the Short; became master of the whole territory of the Franks in 771; crowned Emperor of the West, with the title of Cæsar Augustus, by Pope Leo III., 800. His empire extended from the Elbe to the Ebro, and from Calabria to Hungary. He was the founder of the Carlovingian line of kings. Born, 742; died, 814.

Charles V. (I. of Spain). Emperor of Germany and King of Spain; summoned the Diet of Worms to put down Luther in 1521; opposed the Protestants, but made concession to them by the treaty of Passau 1552; abdicated 1552, and withdrew to the monastery of St. Yuste, Spain. Born, 1500; died, 1558.

Charles XII. King of Sweden, 1697–1718. Soldier and conqueror. Peter the Great of Russia, Frederick IV. of Denmark, and Augustus of Poland made a league against him in 1700. He besieged Copenhagen, and forced Denmark to make peace; beat the Russians, and in the next campaign invaded Poland, where he compelled Augustus to resign; invaded Russia, and was defeated (1709) at Pultowa; found refuge in Turkey, from which he soon returned; invading Norway, he was killed at the siege of Frederickshalle. Born, 1682; died, 1718.

Charles the Bold. Duke of Burgundy. Warred with Louis XI. of France and Rene of Lorraine; killed fighting the Swiss allies of the latter. Born, 1433; died, 1477.

Chase, Salmon P. American statesman and jurist. Secretary of the Treasury. Chief Justice of the U. S. Born, 1808; died, 1873.

Chateaubriand, Francis A., Viscount of. French poet and prose writer. *Genie du Christianisme. Atala.* Born, 1768; died, 1848.

Chatham, William Pitt, First Earl of. English statesman and orator. "The Great Commoner;" entered Parliament, 1735; opposed Walpole's ministry; Premier, 1757; opposed taxation of the American Colonies. Born, 1708; died, 1778.

Chaucer, Geoffrey. English poet. *The Canterbury Tales; The Court of Love; Legend of Good Women; Troilus and Cresseide.* Born, 1328; died, 1400.

Cherubini, Maria L. C. Z. S. Italian musical composer. Among his works are *Medee*, *Elisa*, *Ali Baba*, and, in sacred music, the *Requiem.* Born, 1760; died, 1842.

Chesterfield, Philip D. Stanhope. English orator and wit. Noted for his exquisite manners, on which subject he was the oracle of his day. Born, 1694; died, 1773.

Child, Lydia Maria. American author and philanthropist. Editor "National Anti-slavery Standard." Born, 1802; died, 1880.

Childs, George W. American publisher and philanthropist. Noted for his honesty and benefactions. Born, 1829; died, 1896.

Choate, Rufus. American lawyer, orator, and statesman. Most eloquent advocate of his time; U. S. Senator from Massachusetts. Born, 1799; died, 1859.

Chopin, Frederick. Polish composer and pianist. His works are perhaps the best of piano music. Born, 1810; died, 1849.

Cicero, Marcus Tullius. Roman orator, statesman, and author. In his consulship suppressed the conspiracy of Catiline; went in exile in 58 B. C. but was recalled; was a Pompeian, but enjoyed the favor of Cæsar; was slain by soldiers under orders from Antony. His work *On Old Age* is perhaps the best known of his writings. Born, B. C. 103; died, 46.

Clay, Henry. American orator and statesman. Born in Virginia; Speaker of U. S. Congress, 1811; signed treaty of Ghent, 1815; elected Speaker, 1815, and thrice re-elected; Secretary of State, 1825; U. S. Senator, 1832–42; Whig candidate for President, 1844; re-elected to Senate, 1848. Born, 1777; died, 1852.

Clemens, Samuel L. American humorist, who under the pen name of "Mark Twain" contributed the richest humor of the century; *The Innocents Abroad; Following the Equator.* Born, 1835.

Cleopatra. Queen of Egypt. Joint sovereign of Egypt with her brother Ptolemy; was beautiful and accomplished, but voluptuous; lived with Cæsar at Rome (46–44); in 41, became the favorite of Mark Antony; at the battle of Actium she fled; escaped Augustus by killing herself with an asp. Born, B. C. 69; died, 30.

Cleveland, Grover. Twenty-second President of the United States. Born at Caldwell, New Jersey; went to Buffalo, and was admitted to the bar in 1859. In 1881 he was elected Mayor of Buffalo, and in 1882 became Governor of New York. He served two terms as President of the United States, 1885–1889 and 1893–1897, being defeated for the intervening term by Benjamin Harrison, the Republican candidate. Born, 1837.

Clinton, DeWitt. American statesman. Governor of New York; U. S. Senator; Federal candidate for President; promoter of the Erie Canal. Born, 1769; died 1828.

Cobden, Richard. English statesman and economist. Leader of the Anti-Corn Law League. Born, 1804; died, 1865.

Coleridge, Samuel Taylor. English poet and philosopher. *The Ancient Mariner;* with Wadsworth wrote *Lyrical Ballads;* published *Christabel; Biographia Literaria; Aids to Reflection;* was a slave to opium. Born, 1772; died, 1834.

Coligny, Gaspard de. French admiral. Huguenot leader; killed in the massacre of St. Bartholomew. Born, 1517; died, 1572.

Colt, Samuel. American inventor; Colt's revolver. Born, 1814; died, 1862.

Columbus, Christopher. Discoverer of America. Born in Genoa; expected by sailing westward to find India; left Palos (Aug. 3, 1492) with 3 vessels; discovered San Salvador Oct. 12; visited Cuba and Hayti; 1493 discovered Porto Rico and Jamaica; 1498 continent at mouth of Orinoco; 1502 Honduras; died in poverty and neglect. Born, 1436; died, 1506.

Comte, Auguste. French philosopher. Founder of Positivism. *Course of Positive Philosophy.* Born, 1798; died, 1857.

Confucius, (Kung-futse). Chinese philosopher and theologian. Came forward as a religious teacher at 22. His philosophy related to the present life only; had nothing to do with physics or metaphysics. His influence in the East has been enormous. Born, B. C. 551; died, 479.

Conger, Edwin H. American diplomatist. Congress, 1885-1891; Minister to Brazil, 1891-1895; to China, 1898. Rescued from "Boxer" siege in 1900 by allied forces. Born, 1843.

Conkling, Roscoe. American Republican, lawyer, and statesman. U. S. Senator from New York. Born, 1828; died, 1888.

Constantine I. ("The Great"). Roman Emperor (306-337). Removed the Capital of the Empire to Byzantium. Born, 272; died, 337.

Cook, Captain James. English circumnavigator of the globe, and discoverer. Killed by Hawaiians. Born, 1728; died, 1779.

Cooper, Peter. American philanthrophist. Founder of Cooper Union. Born, 1791; died, 1883.

Cooper, James Fenimore. American novelist. Among his works are *The Spy*, *The Pioneers*, *The Pilot*, *The Red Rover*, *The Last of the Mohicans*, *The Pathfinder*, *The Deerslayer.* Born, 1789; died, 1851.

Cope, Edward Drinker. American naturalist and comparative anatomist. One of the foremost palæontologists of the world. Editor *American Naturalist.* Born, 1840; died, 1897.

Copernicus, Nicholas. German astronomer. Demolished the Ptolemaic theory of the universe and demonstrated that the sun is the center of the universe in his great work *The Revolution of the Celestial Orbs.* Born, 1473; died, 1543.

Corday, Charlotte de. Slayer of Marat. Born, 1768; died, 1793.

Corelli, Marie. English novelist. A step-daughter of Charles Mackay, the poet. *Romance of Two Worlds*, *Barabbas*, *The Sorrows of Satan.* Born, 1864.

Cornell, Ezra. American philanthrophist. Founder of Cornell University. Born, 1807; died 1874.

Cortez, Hernando. Spanish conqueror of Mexico. Born, 1485; died, 1547.

Cornwallis, Charles. Noted British general. Surrendered to George Washington at Yorktown, 1781, thus practically closing the War for Independence. Born, 1738; died, 1805.

Cowper, William. English poet. Published his great work, *The Task*, in 1785. His letters are among the best in the language. Born, 1731; died, 1800.

Crane, Stephen. American author. *The Red Badge of Courage*, and other stories. Also noted war correspondent in 1898. Born, 1871; died, 1900.

Crawford, F. Marion. American novelist. Nephew of Julia Ward Howe. *Mr. Isaacs*, *Paul Patoff*, etc. Born, 1854.

Cranmer, Thomas. Archbishop of Canterbury. Reformer. Burnt as a Christian martyr. Born, 1489; died, 1556.

Crispi, Francesco. Italian statesman. A revolutionist with Garibaldi; Prime Minister of Italy 1887–90 and 1894. Born, 1819; deid ,1901.

Crockett, David. American pioneer and hunter, famous for his bravery and eccentricities. Served several years in Congress; joined the Texan patriots in 1836 and was massacred by Mexicans at the Alamo. Born 1786; died, 1836.

Crœsus. King of Lydia. Famous for his wealth. Born, B. C. 590; died, 546.

Cromwell, Oliver. Lord Protector of England. Entered army as captain of cavalry, 1642; signed death warrant of Charles I., 1649; routed the Scotch at Dunbar, beat Charles at Worcester, 1651; dissolved Parliament, 1653; was created Protector, 1654. Born, 1599; died, 1658.

Cruikshank, George. English caricaturist. *Comic Almanack.* Born, 1792; died, 1878.

Curtis, George William. American orator, author and journalist. *Nile Notes; Potiphar Papers.* Born 1824; died, 1892.

Cushing, Caleb. American lawyer, diplomatist and statesman. Attorney-General of the United States; Minister to China. *The Treaty of Geneva.* Born, 1800; died, 1879.

Cushman, Charlotte S. American actress. Great as *Meg Merrilies.* Born, 1816; died, 1876.

Cuvier, George C. L. D., Baron de. French naturalist. *Animal Kingdom*, *Natural History of Fishes;* was founder of the science of comparative anatomy. Born, 1769; died, 1832.

Cyrus, The Great. Founder of the Persian Empire and greatest of Persian kings. Killed in battle 529 B. C.

Dallas, George M. American Democratic politician. Vice-President, 1845–49. Born, 1792; died, 1864.

Dalton, John. English natural philosopher. Propounder of the atomic theory. *New System of Chemical Philosophy.* Born, 1766; died, 1844.

Dana, Charles A. American journalist. Editor of the New York *Sun.* Born, 1819; died, 1898.

Dana, Richard Henry. American poet and man of letters. *The Buccaneer*, *The Dying Rover*, *The Idle Man.* Born, 1787; died, 1879.

Dana, Richard Henry. Son of the above. American lawyer and author. *Two Years Before the Mast.* Editor of *Wheaton's International Law.* Born, 1815; died, 1882.

Daniel. One of the four greater Hebrew prophets. Taken prisoner by Nebuchadnezzar. Highly honored by Kings Darius and Cyrus.

Dante degli Alighieri. Greatest Italian poet. *The Divine Comedy.* Passed much of his time in exile from Florence for political causes. Wrote *The New Life* (*Vita Nuova*), the *Convito*, treatise on the Italian language, *De Vulgari Eloquio*, and *De Monarchia.* Born, 1265; died, 1321.

Danton, George J. French Revolutionist. Head of the "Dantonists." Minister of Justice. Guillotined. Born, 1759; died, 1794.

Darius I. (Hystaspes). King of Persia. B. G., 521-485. Began the wars with the Greeks. His Satraps Datis and Artaphernes were defeated at Marathon. Born, B. C. ——; died, 485.

Darius III. (Codomannus). King of Persia. B. C. 336-330. Defeated and dethroned by Alexander the Great. Born, B. C. 380; died, 330.

Darwin, Charles R. English naturalist. Originator of the theory of evolution by natural selection. *Origin of Species; The Descent of Man; The Fertilization of Orchids.* Born, 1809; died, 1882.

David. King of Israel. Distinguished as general, statesman, poet and prophet. Lived 1090 to 1015 B. C.

Da Vinci, Leonardo. Italian painter, sculptor, engineer and universal genius. *The Lord's Supper.* Among his works are *Madonna*, *Lisa del Giocondo* and *The Virgin on the Knees of St. Anne.* Born, 1452; died, 1519.

Davis, Jefferson. American statesman; colonel in Mexican war, elected to U. S. Senate, 1847; Secretary of War, 1853-57; re-elected to Senate, 1857; President Southern Confederacy, 1861-65. Born, 1808; died, 1889.

Davis, Rebecca Harding, and her son, *Richard Harding*. American novelists. The latter also a spirited war correspondent in Cuba, 1898, and South Africa, 1900. Born, first, 1831; second, 1864.

Dawson, Sir J. William. Canadian geologist. An original investigator, writer, and teacher. Born, 1820; died, 1899.

Davy, Sir Humphrey. An English chemist of great eminence. President of the Royal Society; author many valuable scientific works. Born, 1778; died, 1829.

Decatur, Stephen. American naval officer. Distinguished himself in Tripoli, 1804, and in War of 1812 with England. Killed in duel. Born, 1779; died, 1820.

DeFoe, Daniel. English novelist. Produced his great work, *Robinson Crusoe*, in 1719; *Moll Flanders*, 1721; *Colonel Jack*, 1721. Born, 1661; died, 1731.

Demosthenes. Greatest Greek orator. Was an opponent of Philip of Macedon, against whom, between 352 and 340 B. C., he delivered his 11 *Phillipics.* It being proposed to give him a crown, Æschines opposed; this was the cause of the noblest speech of Demosthenes, that *On the Crown.* Born, B. C., 385; died, 322.

Depew, Chauncey M. American railway director, politician, and humorous orator; elected U. S. Senator in 1899. Born, 1834.

DeQuincey, Thomas. English author. Contracted opium habit. *Confessions of an Opium Eater.* Born, 1785; died, 1859.

Descartes, René. French philosopher and metaphysician. *Principles of Philosophy*; made many discoveries in algebra and geometry. Born, 1596; died, 1650.

Dewey, George. Admiral American Navy; hero of battle of Manila (1898); triumphant return to America in 1899. Born, 1837.

Dickens, Charles. English novelist. Published *Sketches by Boz*, 1836; *Pickwick Papers*, *Oliver Twist*, *Nicholas Nickelby*, *The Old Curiosity Shop*, etc. Born, 1812; died, 1870.

Diogenes. Greek cynic philosopher. Surly and independent inhabitant of a tub. Born, B. C., ——; died, 323.

Disraeli, Benjamin, Earl of Beaconsfield. English statesman and novelist. Premier (1874-1880). *Coningsby*, *Vivian Grey*, *Henrietta Temple*, *Endymion*, *Lothair.* Born, 1805; died, 1881.

Donnelly, Ignatius. American author and politician. Nominated for Vice-President People's Party ticket, 1900. *The Great Crytogram*, *Cæsars Column*, etc. Born, 1831; died, 1901.

Dore, Gustave. French painter and illustrator. Illustrated Dante's *Inferno*, *Don Quixote*, *Paradise Lost*, *Idylls of the King*, etc. Painted *Francesca de Rimini*, *Christ Leaving Prætorium*, etc. Born, 1832; died, 1883.

Douglas, Stephen A. American Democratic politician. Senator from Illinois. *The Kansas-Nebraska Bill.* Born, 1813; died, 1861.

Draco. Athenian legislator. Noted for the severity of his laws. Born, B. C. 7th century.

Drake, Sir Francis. English navigator and admiral. Preyed upon Spanish commerce; burned 100 Spanish vessels in Cadiz. Born, 1545; died, 1596.

Dreyfus, Albert. A French army officer. Persecuted because of his Jewish blood, as the scapegoat for criminal officers. Sentenced to perpetual imprisonment, 1894, but secured new hearing and was pardoned, 1899.

Drummond, Henry. British author and teacher. *Natural Law in the Spiritual World*, *The Ascent of Man*, *The Greatest Thing in the World*, etc. Born, 1851; died, 1897.

Dryden, John. English poet and dramatist. Appointed poet-laureate, 1670; produced *Absalom and Achitophel*, *Ode on Alexander's Feast*, *Fables.* Of his dramatic works, *All for Love* is the best. Born, 1631; died, 1700.

Dumas, Alexandre. French novelist. *The Three Musketeers.* Born, 1803; died, 1870.

Dumas, Alexandre (Jr.). French novelist and dramatist. *La Dame aux Camelias.* Born, 1824.

Du Maurier, George L. P. B. Born in Paris; satirical illustrator for *Punch*; novelist. *Peter Ibbetson*, *Trilby.* Born, 1834; died, 1896.

Eads, James Buchanan. American engineer. Built the St. Louis bridge; deepened the channel of the Mississippi. Born, 1820; died, 1887.

Ebers, George Moritz. German Egyptologist and writer. *An Egyptian Princess*, *Homo Sum*, *Cleopatra.* Born, 1837; died, 1898.

Eddy, Mary Baker Glover. American theologian. Founder of Christian Science. Author of *Science and Health*, etc.

Edison, Thomas Alva. A celebrated American inventor. Born at Milan, Ohio; started life as a newsboy; made important inventions in telegraphy, electric lighting, etc. Also invented the phonograph. Born, 1847.

Edward VII. King of England. Succeeded Queen Victoria in 1901. Born, 1841.

Edwards, Jonathan. American metaphysician. Ablest defender of Calvinism. *On the Freedom of the Will.* Born, 1703; died, 1758.

Eggleston, Edward. American novelist and historian; Minister of Methodist Church. *The Hoosier Schoolmaster*, and several historical works. Born, 1837.

Eliot, John. *The Apostle of the Indians.* American preacher and missionary to the Indians. Translated the Bible into Indian language. Born, 1604; died, 1690.

Elizabeth. Queen of England. Daughter of Henry VIII. Among the great events of her reign were the repulse of the Spanish Armada, and the execution of Mary Queen of Scots. Born, 1523; died, 1603.

Emin Pasha. An African explorer, of German birth; original name Edward Schnitzler. Entered the Egyptian service; governor of the equatorial province, 1878; cut off from world by the Mahdi outbreak; rescued by Henry M. Stanley in 1889; killed by Arabs in later travels. Born, 1840; died, 1892.

Emerson, Ralph Waldo. American transcendental philosopher and poet. Was for a time a Unitarian minister in Boston; *English Traits*, *The Conduct of Life*, *Poems*, *Society and Solitude*, *Essays.* Born, 1803; died, 1882.

Emmett, Robert. Irish patriot; Executed for treason. Born, 1780; died, 1803.

Epictetus. Greek Stoic philosopher and moralist. *Enchiridion.* Flourished in 2d century.

Epicurus. Greek philosopher. Founder of the Epicureans. Born, B. C. 342; died, 270.

Erasmus, Desiderius. Noted Dutch scholar. One of the most profoundly learned men of modern times. In 1570 became professor of Divinity and Greek at Cambridge. Works published in ten folio volumes. Born, 1465; died, 1536.

Eric the Red. Scandinavian navigator. Supposed to have discovered Greenland about 982, and his son, Lief Eric, is supposed to have visited New England about 1000.

Ericsson, John. Swedish engineer and inventor. In 1836 patented the first successful screw propeller. Immigrated to America. In 1861 built the iron-clad *Monitor*, revolutionizing the construction of warships. Born, 1803; died, 1889.

Euclid. Alexandrian mathematician. *Elements of Geometry.* Born B. C., 4th century.

Eugene, Francis, Prince of Savoy. One of the greatest generals of his time; co-operated with Marlborough at Blenheim, Oudenarde, and Malplaquet. Born, 1663; died, 1736.

Euripides. Third in merit of the great Greek tragedy writers. *Alcestis.* Born, B. C. 480; died, 406.

Evans, Marian (George Eliot). English novelist. *Scenes of Clerical Life*, *Adam Bede*, *The Mill on the Floss*, *Romola*, *Middlemarch*, etc. Born, 1820; died, 1880.

Evarts, William M. American lawyer and statesman. Attorney-General of the United States; Secretary of State. Born, 1816; died, 1901.

Everett, Edward. American orator, statesman and diplomatist. U. S. Senator; Minister to Great Britain. *Orations and Speeches.* Born, 1794; died, 1865.

Ezekiel. One of the four greater Hebrew prophets. Contemporary and fellow-prisoner in Babylon with Daniel. Lived about 600 B. C.

Faraday, Michael. English man of science. Founder of the science of magneto-electricity. *Experimental Researches in Electricity.* Born, 1791; died, 1867.

Farragut, David Glascoe. American Admiral. Entered navy 1812; commander, 1841; passed New Orleans forts and took New Orleans, 1862; made Rear Admiral same year; attacked defenses at Mobile, 1864; Admiral, 1866. Born, 1801; died, 1870.

Farenheit, Gabriel D. German natural philosopher. Fahrenheit's thermometer. Born, 1686; died, 1736.

Fawkes, Guy. An English conspirator. Principal in the Gunpower Plot to blow up the House of Parliament. Executed 1606.

Fenelon, Francois de Salignac. Noted French archbishop, author and orator. Among his works are *Telemachus*, *Maxims of the Saints*, *Dialogues on the Eloquence of the Pulpit*, etc. Born, 1651; died, 1715.

Fessenden, William Pitt. American Republican Senator, and Secretary of the Treasury. Born, 1806; died, 1869.

Field, Cyrus W. American capitalist. Laid the first Atlantic cable. Born, 1819; died, 1892.

Fielding, Henry. English novelist. *Tom Jones*, *Joseph Andrews*, *Jonathan Wild*, *Amelia.* Born, 1707; died, 1754.

Fillmore, Millard. American President, 1850–53. Born in New York; learned fuller's trade; studied law; member of Congress, 1832–42; elected Vice-President, 1848; became President on death of Taylor. Born, 1800; died, 1874.

Fish, Hamilton. American statesman. U. S. Congressman and Senator. Governor New York, 1847; Secretary of State under U. S. Grant, 1869 to 1877. Born, 1808; died, 1895.

Foote, Andrew Hull. American Rear-Admiral. Distinguished in Civil War. Born, 1806; died, 1863.

Ford, Paul Leicester. American author. *The Hon. Peter Sterling*, *Janice Meredith*, and *Biographies of Washington and Franklin.* Born, 1865. Died, 1902.

Forrest, Edwin. American tragedian. Eminent as *Metamora*, *the Gladiator*, *Virginius.* Born, 1806; died, 1872.

Fox, Charles James. English orator and statesman. Entered Parliament, 1768, as a Tory; opposed policy of Pitt. Born, 1749; died, 1806.

Fox, George. English religionist. Founder of the Society of Friends. Born, 1624; died, 1690.

Franklin, Benjamin. American statesman and philosopher. Born in Boston; learned printer's trade; removed to Pennsylvania; published *Poor Richard's Almanac;* discovered identity of lightning and electric fluid, 1752; deputy postmaster-general of the colony; agent of the Penns in England; delegate to Continental Congress;

Minister to France, 1776–85; President of Pennsylvania, 1785-87; member Constitutional Convention of 1787. Born, 1706; died, 1790.

Franklin, Sir John. English Arctic explorer. Lost in Arctic regions. Born, 1786; died, 1847.

Frederick II. ("The Great"). King of Prussia. Came to the throne in 1740, and invaded Silesia, which Maria Theresa ceded to him in 1742. Russia, France, and Austria began Seven Years' War against him and England (1756). He won a great victory at Prague (1757), but was defeated by Daun soon afterward; the same year defeated the French at Rossbach, and the Austrians at Leuthen. Peace was made in 1763. At the partition of Poland (1772) he got Prussian Poland. Born, 1712; died, 1786.

Freeman, Edward Augustus. English historian. Professor of Modern History at Oxford. *The Norman Conquest*, etc. Born, 1823; died, 1892.

Fremont, John Charles. American explorer, politician, and general. Republican candidate for President in 1856. Born, 1813; died, 1890.

Frœbel, Frederick. German educator. Introducer of the "Kindergarten" system. Born, 1782; died, 1852.

Froissart, Jean. French chronicler. *Les Chroniques.* Born, 1337; died, 1410.

Froude, James A. English historian. *History of Henry III.*, *Short Studies on Great Subjects.* Born, 1818; died, 1894.

Fry, Elizabeth. English philanthropist. Devoted to prison reform. Born, 1780; died, 1845.

Fulton, Robert. American inventor of the steamboat. Built (1807) the steamer *Clermont*, which made regular trips between New York and Albany. Born, 1765; died, 1815.

Funston, Frederick. American soldier. Served in the Cuban rebellion and in the Philippines. Famous for his daring; captured Aguinaldo in 1901; rewarded with rank of brigadier-general. Born, 1865.

Gage, Lyman W. American financier. Secretary of Treasury under President McKinley. Born, 1836.

Galilei, Galileo. Italian astronomer. Professor of mathematics at Padua and Pisa. Discovered law by which the velocity of falling bodies is accelerated. Constructed a telescope in 1619. Published *Dialogues on the Ptolemaic and Copernican Systems.* Born, 1564; died, 1642.

Gall, Franz Joseph. German physician. Founder of the system of phrenology, and with Dr. Spurzheim, his pupil, lectured on the subject throughout Europe. Born, 1758; died, 1828.

Galvani, Louis. Italian physicist. Discoverer of galvanism. Born, 1737; died, 1798.

Gambetta, Leon. French radical orator and statesman. President of the Chamber of Deputies. Born, 1838; died, 1882.

Garfield, James A. American President. Born in Ohio; brigadier-general, 1862; major-general for services at Chickamauga; M. C., 1862-1881; elected to Senate, 1880; elected President, 1881; shot by Charles J. Guiteau, July 2, 1881; died September 19. Born, 1831; died, 1881.

Garland, Augustus H. American statesman. Member Confederate Congress, 1861-65; United States senator; Governor of Arkansas, 1874; Attorney-General of the U. S. under Cleveland, 1885. Born, 1832.

Garibaldi, Giuseppe. Italian patriot and general. Liberator of Italy. Born, 1807; died, 1882.

Garrick, David. English actor. Made his debut as *Richard III.* in 1741. Among his great parts were *Lear*, *Macbeth*, *Romeo*, *Hamlet*, *Abel Drugger;* buried in Westminster Abbey. Born, 1716; died, 1779.

Garrison, William Lloyd. American journalist and Abolitionist. Born at Newburyport, Mass.; at Boston, in 1831, he founded his celebrated *Liberator.* Born, 1804; died, 1879.

Gounod, Charles Francois. French composer. Of his operas *Faust* is the best known. Born, 1818; died, 1893.

Genghis, Khan. Great Mongolian warrior and conqueror. Subjugated China and Persia. Born, 1163; died, 1227.

George III. King of England. Lost American colonies; insane latter part of his life. Born, 1738; died, 1820.

George, Henry. American economist. Published *Progress and Poverty* in 1879. Advocated single tax on land. Twice candidate for Mayor of New York; died in 1897 before the election. Born, 1839; died, 1897.

Gibbon, Edward. English historian. *Decline and Fall of the Roman Empire.* Born, 1737; died, 1794.

Gladstone, William Ewart. Statesman, orator, and scholar. Born at Liverpool, son of a Liverpool merchant; educated at Eton and Oxford; entered Parliament in 1832; in 1859, under Lord Palmerston, became Chancellor of the Exchequer; in 1865, he became leader of the Commons under Lord John Russell; became Premier for the first time in 1869, holding office till 1875; in 1880, became Premier for the second time; a third time in 1886, and a fourth time in 1892; failed from desertion in the Liberal ranks to carry his measure of Home Rule for Ireland; retired from office into private life in 1895; author of several works. Born, 1809; died, 1898.

Godfrey of Bouillon. King of Jerusalem. Hero of the first Crusade. Born, 1058; died, 1100.

Goethe, John Wolfgang von. German poet, dramatist, critic, novelist, man of science, statesman. *Faust*, *Iphigenia in Tauris*, *Wilhelm Meister*, *Egmont*, *Sorrows of Werther*, and many noble lyrical poems. In almost every department of literature, first among the Germans. Born, 1749; died, 1832.

Goldsmith, Oliver. Irish poet, novelist, and historian. *Vicar of Wakefield*, *The Traveller*, *The Deserted Village.* Born, 1728; died, 1774.

Goodrich, Samuel G., "Peter Parley." American writer. *Peter Parley's Own Story.* Born, 1793; died, 1860.

Gordon, Charles George. English soldier and administrator. Overthrew the Taiping rebellion in China; entered the service of Egypt and became Governor of the Soudan; slain by the troops of the Mahdi in Khartoum. Born, 1833; died, 1885.

Gough, John B. American temperance orator. Born, 1817; died, 1886.

Gracchus, Tiberius. Roman tribune and demagogue. Passed agrarian law; murdered. Born, B. C. 163; died, 133.

Grant, Ulysses S. American general and President. Born in Ohio; graduated at West Point, 1839; served in Mexican War; brigadier-general 1861; took Fort Donelson, 1862; Vicksburg, 1863; lieutenant-general, 1864; President, 1869-77. Born, 1822; died, 1885.

Gray, Thomas. English poet. Professor of modern history at Cambridge. *Pindaric Odes; Elegy Written in a Country Churchyard.* Born, 1716; died, 1771.

Greeley, Horace. American journalist and politician. Founded the *New York Tribune* in 1841. Till his death he advocated temperance, anti-slavery, socialistic, and protectionist principles; in 1872 he unsuccessfully opposed Grant for the Presidency. His works include *The American Conflict*, *Recollections*, *Essays*, etc. Born, 1811; died, 1872.

Gregory I., "The Great." Pope. Converter of Britain. Born, 545; died, 604.

Gregory VII. (Hildebrand). Greatest of the Popes. Elected Pope in 1073; the Emperor, Henry IV., of Germany, deposed him, and was excommunicated. After a humiliating penance at Canossa, Henry was pardoned, but the reconciliation was only temporary. Born, 1015; died, 1085.

Grey, Lady Jane. English lady. Distinguished for rare talents. Edward VI. made her his sucsessor as sovereign, and because of her acceptance she was imprisoned in the Tower and afterwards executed. Born, 1537; died, 1554.

Grote, George. English historian. *History of Greece.* Born, 1794; died, 1871.

Guizot, Francois P. G. French statesman and historian. Minister of Foreign Affairs. *History of France.* Born, 1787; died, 1874.

Guillotine. Joseph Ignace. A French physician after whom the Guillotine was named; he having recommended it as a more humane method of capital punishment. Born, 1738; died, 1814.

Gustavus II. (Adolphus). King of Sweden. General. Began to reign in his seventeenth year; soon afterward defeated the Czar and the King of Poland; invited to become the head of the Protestant party in Germany, he entered Pomerania with 8,000 men, and took town after town; defeated (1631) Marshal Tilly at Leipzig, and the next year on the banks of the Lech, where Tilly was slain. The Emperor now called in the great Wallenstein to oppose Gustavus; the two generals met at Lutzen; Gustavus was mortally wounded, but the imperial army under Wallenstein was repulsed. Born, 1594; died, 1632.

Gutenburg, Johannes or Henne, also called Gensfleisch. Claimed by the Germans to have been the inventor of the art of printing with movable types; he set up his first printing-press at Mainz about 1450. Born, 1400; died, 1468.

Hæckel, Ernst Heinrich. German naturalist and evolutionist. Made valuable researches on the lower animals; wrote popular works on science. Born, 1834.

Hahnemann, Samuel C. F. German founder of homœopathy. Proposed homœopathy, 1796; published *Organum of Rational Medicine*, 1810. Born, 1755; died, 1843.

Hale, Edward Everett. American author and Unitarian minister. *The Man Without a Country*, etc. Born, 1822.

Halleck, Fitz-Greene. American poet. *Marco Bozzaris.* Born, 1790; died, 1867.

Hamilton, Alexander. American statesman and financier. Born in Island of Nevis, West Indies. Aide-de-camp and secretary to Washington in Revolutionary War; leading member of the Convention of 1787; principal author of the *Federalist;* Secretary of the Treasury, 1789–95; killed in a duel by Aaron Burr. Born, 1757; died, 1804.

Hamilton, Sir William. Scotch metaphysician. Born, 1788; died, 1856.

Hampton, Wade. American general and Senator. Governor South Carolina in 1876; U. S. Senator, 1878. Born, 1818.

Hancock, John. American Revolutionary statesman; President of the Continental Congress. Born, 1737; died, 1793.

Hancock, Winfield S. American general. Commanded at Gettysburg; Democratic candidate for President in 1880. Born, 1824; died, 1886.

Handel, George F. German composer. Composed sonatas at ten. His oratorio of *Saul* was produced, 1740; his masterpiece, the *Messiah*, 1741, Among his other works are *Moses in Egypt. Samson*, and *Jepthah.* Born, 1684; died, 1739.

Hannibal. Carthaginian general against Rome. Son of Hamilcar, who swore him to eternal enmity with the Romans; captured Saguntum, 219 B. C.; crossed the Alps, 218; destroyed Roman army at Cannæ; defeated by Scipio at Zama, 202; finally poisoned himself to escape falling into the hands of the Romans. Born B. C. 247; died, 183.

Harris, Joel Chandler. An American writer; born in Georgia. Author of *Uncle Remus.* and other folklore stories. Born, 1848.

Harrison, Benjamin. Twenty-third President of the United States. Was born at North Bend, Ohio; graduated from Miami University in 1852; began the practice of law in Indianapolis. Served in the Union army during the Civil War; entered United States Senate in 1881; served one term as President of the United States, 1889–1893; defeated for second term. He was the grandson of William Henry Harrison, ninth President of the United States. Born, 1833; died, 1901.

Harrison, William Henry. American President. General; Governor of Indiana, 1801–13, defeated Indians at Tippecanoe; elected to Congress, 1817; to the Senate, 1824; Minister to Columbia, 1828; Whig candidate for President, 1836; elected President, 1840. Born, 1773; died, 1841.

Harte, Francis Bret. American novelist and poet. *The Heathen Chinee; Gabriel Conroy; Luck of Roaring Camp.* Born, 1839. Died 1902.

Harvard, John. Colonial divine. Benefactor of Harvard College, which was given his name. Born, 1608; died, 1688.

Harvey, William. English physician. Discoverer of the circulation of the blood. Born, 1578; died, 1657.

Hastings, Warren. British statesman and general; President of the Council of Bengal; conqueror of Hyder Aly; impeached for cruelty, but acquitted. Born, 1733; died, 1818.

Hawthorne, Nathaniel. American romance writer. *Marble Fawn; The Scarlet Letter; The House of Seven Gables; The Blithdale Romance; Mosses from an Old Manse.* Born, 1804; died, 1864.

Haydn, Francis Joseph. German composer. Between the ages of nineteen and twenty-six, composed many sonatas, concertos, and symphonies; produced 1798, his masterpiece, *The Creation.* Born, 1732; died, 1809.

Hayes, Rutherford B. American President. Born in Ohio; admitted to bar, 1845; brigadier-general in Civil War; entered Congress at its close; re-elected, 1866; Governor of Ohio, 1868–76; President United States, 1877–81. Born, 1822; died, 1893.

Hayne, Robert T. American lawyer and Senator. Governor of South Carolina; opponent of Webster in discussing the Constitution and State rights. Born, 1791; died, 1839.

Hegel, George W. F. German philosopher. Professor of philosophy at Heidelberg and Berlin. He developed his system of philosophy in the *Encyclopædia of Philosophical Science.* Born, 1770; died, 1831.

Heine, Heinrich. German lyric poet and satirist. *Reisebilde; Lieder.* Born, 1799; died, 1856.

Helmholtz, Hermann von. German physicist. Famous for his researches in physiology, surgery, light, sound, etc. Born, 1821; died, 1894.

Henry IV. "The Great." (Henry of Navarre.) King of France. Won battle of Ivry; issued Edict of Nantes. Born, 1553; died, 1610.

Henry V. King of England. Conqueror at Agincourt. Born, 1388; died, 1422.

Henry VIII. King of England. "Defender of the Faith." Suppressed the monasteries; founded the Church of England. Born, 1491; died, 1547.

Henry, Patrick. American orator and revolutionary patriot. "Give me Liberty, or give me Death." Born, 1736; died, 1799.

Herodotus. Greek historian. *History.* Born, B. C. 484; died, 408.

Herschel, Sir William. English astronomer. Discoverer of Uranus. Born, 1738; died, 1822.

Herschel, Sir John F. W. English astronomer. *Preliminary Discourse on the Study of Natural Philosophy.* Born 1792; died, 1871.

Higginson, Thomas Wentworth. An American author and abolitionist. During the Civil War he commanded the first regiment of freed slaves; subsequently he resumed literary work. *History of the United States; Army Life in a Black Regiment,* etc. Born, 1823.

Hirsch, Baron Maurice de. Jewish financier and philanthropist. Born, 1830; died, 1896.

Hobart, Garrett A. Vice President U. S. with McKinley, 1896. Born, 1844; died, 1899.

Hogarth, William. English painter. *The Rake's Progress.* Born, 1697; died, 1764.

Holmes, Oliver Wendell. American poet, physician, and novelist. *Elsie Venner; The Autocrat of the Breakfast Table; The Guardian Angel; Poems.* Born, 1809; died, 1897.

Homer. Greek epic poet. *Iliad* and *Odyssey.* The times of his birth and death are uncertain, and his existence is doubted by some, who maintain that the *Iliad* and *Odyssey* are collections of songs by different authors. Born, B. C. 10th century.

Hood, Thomas. English poet and humorist. *Song of the Shirt, Whims and Oddities, Eugene Aram's Dream.* Born, 1789; died, 1845.

Hooker, Joseph. American general. Commander of the Army of the Potomac, 1863; defeated at Chancellorsville. Born, 1815; died, 1879.

Horace (Q. Horatius Flaccus). Latin poet and satirist. *Odes, Epistles, Satires.* Born, B. C. 65; died, 8.

Houston, Samuel. American general and statesman. Commander-in-chief of the Texan army; captured Santa Anna; Governor of Texas. Born, 1793; died, 1863.

Howard, John. English philanthropist and prison reformer. *The State of the Prisons in England.* Born, 1726; died, 1790.

Howe, Elias. American inventor. Invented the sewing machine. Born, 1819; died, 1867.

Howe, Julia Ward. American author and editor. Advocate of Woman's Suffrage. Made famous by her *Battle Hymn of the Republic.* Born, 1819.

Howells, William Dean. American novelist. *A Chance Acquaintance, A Foregone Conclusion, A Modern Instance, An Indian Summer,* are among his more popular works. Born, 1837.

Hugo, Victor. French poet, dramatist, and novelist. *Les Miserables*; *Notre Dame.* Born, 1802; died, 1885.

Humboldt, F. H Alexander von. German naturalist. *Cosmos, an Essay of a Physical Description of the Universe,* etc. Born, 1769; died, 1859.

Humbert I. King of Italy. Succeeded to the throne in 1878; assassinated by an anarchist in 1900. Born, 1844; died, 1900.

Hume, David. Scottish philosopher and historian. *History of England, Enquiry into the Principles of Human Nature.* Born, 1711; died, 1776.

Huss, John. Bohemian reformer. *On the Church.* Was burned at the stake. Born, 1376; died, 1415.

Ibsen, Henrik. Norwegian dramatist. Famous for his plays on sociological subjects. *A Doll's House, The Master Builder,* etc. Born, 1828.

Ingelow, Jean. English poet and novelist. *Tales of Orris, A Story of Doom and other Poems.* Born, 1830; died, 1897.

Innocent III. One of the greatest of the Popes. Elected Pope in 1198; put France under the ban, 1199, because Philip Augustus repudiated his queen; Innocent compelled him to take her

back. He organized the fourth Crusade, which resulted in the capture of Constantinople; in 1214 he crushed the Albigensians. Born, 1161; died, 1216.

Irving, Sir Henry (John Henry Brodribb). English actor in Shakesperean and modern roles; knighted in 1895. Born, 1838.

Irving, Washington. American author. Minister to Spain, 1842. *History of New York*, *The Conquest of Granada*, *Life of Washington*, *Columbus*, *The Sketch Book*. Born, 1783; died, 1859.

Isabella. "The Catholic" Queen of Castile. Patroness of Christopher Columbus. Born, 1451; died, 1504.

Ito, Hirobumi, Marquis. Japanese statesman. Premier of Japan; Admiral of Japanese fleet and gained great victory over China, Sept, 1895, off the Yalu River; Prime Minister again, 1900; resigned, 1901. Born, 1840.

Jackson, Andrew. American President and general. Born in North Carolina; began to practice law at Nashville, Tenn., 1788; M. C., 1796; Senator, 1797; Judge Tennessee Supreme Court, 1798–1804; defeated Creek Indians, 1814; won battle of New Orleans, 1815; in Seminole War, 1817–18; Senator, 1823; President, 1829–37. Born, 1767; died, 1845.

Jackson, Thomas J. ("Stonewall.") American Confederate general. Captured Harper's Ferry taking 11,000 prisoners; defeated Banks; accidentally killed by his own soldiers. Born, 1826; died, 1863.

James, Henry. American novelist. *The American*, *Daisy Miller*, *Portrait of a Lady*, etc. Born, 1843.

James I. of England and VI. of Scotland. Son of Mary Queen of Scots. Succeeded Elizabeth to the throne of England 1603. Translation of Bible made under his direction, and known as King James' Version. Born, 1566; died, 1625.

Jay, John. American jurist, diplomatist, and statesman. Negotiated treaty with England. Born, 1754; died, 1829.

Jefferson, Joseph. American actor. Great as *Rip Van Winkle*. Born, 1829.

Jefferson, Thomas. American statesman and President. Born in Virginia, studied law; member Virginia House of Burgesses; in Continental Congress, 1775; drew up Declaration of Independence, 1776; Governor of Virginia, 1779–81; Resident Minister at Paris, 1785–89; Secretary of State, 1789–93; Vice-President, 1797–1801; President, 1801–9. Born, 1743; died, 1826.

Jeffrey, Francis, Lord. Scotch judge and critic. Editor of the *Edinburgh Review*. Born, 1773; died, 1850.

Jeanne D'Arc (The Maid of Orleans). A peasant girl in Lorraine; believing herself inspired by Heaven to raise the siege of Orleans and crown Charles at Rheims, she set out to the king in 1429, was given a command, raised the siege of Orleans in one week, won the battles of Jargeau and Patay, and Charles was crowned at Rheims. Taken in a skirmish by the Burgundians, she was delivered to the English and burned as a sorceress. Born, 1411; died, 1431.

John. King of England. Granter of Magna Charta. Born, 1166; died, 1216.

John III. (John Sobieski.) King of Poland. Expelled the Turks from Austria and Poland. Born, 1629; died, 1696.

Johnson, Andrew. American President. In Congress, 1843–53; Governor of Tennessee, 1853–7; U. S. Senator, 1857; Military Governor of Tennessee, 1862; elected Vice-President, 1864; President on death of Lincoln, April 15, 1865; impeached, but acquitted, 1868; subsequently reelected to the Senate. Born, 1808; died, 1875.

Johnson, Samuel. English poet, critic, and scholar. Born in Lichfield; educated at Oxford; published *London*, *Life of Richard Savage*, *Vanity of Human Wishes*, *Dictionary*, *Rasselas*, *Lives of the Poets*. Born, 1709; died, 1784.

Johnston, Albert Sydney. American Confederate general. Attacked Grant at Shiloh, and was killed. Born, 1803; died, 1862.

Johnston, Joseph E. American general. Served with distinction in Mexico. In 1861, joined Confederate army, in which he distinguished himself. Born, 1807; died, 1891.

Jones, John Paul. American Revolutionary naval officer. Naval victories over British. Born, 1747; died, 1792.

Jonson, Ben. English poet and dramatist, bricklayer and soldier. *Every Man in his Humor*, *Volpone*, *The Alchemist*, *The Silent Woman*, *Sejanus*; *Masques*. Born, 1574; died, 1637.

Josephine. Widow of Alexander de Beauharnais. Wife of Napoleon I.; Empress of France; divorced. Born, 1763; died, 1814.

Josephus, Flavius. Jewish historian. *History of the Jews*. Born, 35; died, 100.

Joubert, Petrus Jacobus. A Boer soldier. Defeated the English in 1881 and Dr. Jameson in 1896; prominent in Boer-English war. Born, 1831; died, 1900.

Julian. "The Apostate." Roman emperor. Restored Pagan worship. Born, 331; died, 363.

Juvenal (Decimus Junius Juvenalis). Latin satirist. *Satires*. Born, 40; died, 125.

Kane, Elisha K. American Arctic explorer. *Arctic Explorations*. Born, 1820; died, 1857.

Kant, Immanuel. German philosopher. *Critique of Pure Reason*. In his *Universal Natural History and Theory of the Universe* he anticipated the discovery of Uranus. Another of his important works is the *Critique of Practical Reason*. It was his aim to determine the laws and limits of human reason and of the human intellect in relation to the objects of human knowledge. Born, 1724; died, 1804.

Kean, Edward. English actor. Among his greatest parts were *Shylock*, *Richard III.*, *Othello*, *Iago*, *King Lear*. Born, 1787; died, 1833.

Keats, John. English poet. Born in London; apprenticed to a surgeon; died at Rome. *Endymion*, *Hyperion*, *The Eve of St. Agnes*. Born, 1795; died, 1821.

Kelvin, William Thomson, Lord. Scotch physicist. Famous for his discoveries in electric and dynamic science, and researches on wave-motion and the ether. Created Lord Kelvin in 1892. Born, 1824.

Kempis, Thomas à. German ascetic writer. *Imitatio Christi*. Born, 1380; died, 1471.

Kepler, John. German astronomer. Discovered the mathematical laws of the solar system. Born, 1571; died, 1630.

Key, Francis Scott. American song-writer. *Star-Spangled Banner*. Born, 1799; died, 1843.

Kingsley, Charles. English divine and novelist. *Hypatia*, *Westward Ho*, *Hereward*. Born, 1819; died, 1875.

Kingsley, Henry. English novelist. *Ravenshoe*. Born, 1830; died, 1876.

Kipling, Rudyard. Story-teller and poet. Born in Bombay, and educated in England. His *Soldiers Three*, and other stories, gained for him an immediate and wide reputation. As a poet, his most successful effort is his *Barrack-Room Ballads*. Born, 1865.

Kitchener, Lord Horatio Herbert. English soldier. Hero of Soudan Campaign in 1898. Boer War 1899 and 1900. Born, 1850.

Knox, John. Scotch Reformer. Fierce anti-Catholic. *The First Blast of the Trumpet*. Born, 1505; died, 1572.

Koch, Robert. German bacteriologist. Born at Klausthal, in Hanover; famous for his researches in bacteriology; discovered sundry bacilli, among others the cholera bacillus and the phthisis bacillus, and a specific against it. Born, 1843.

Kosciusko, Thaddeus. Polish patriot and general. Commander of the Polish insurgent army; defeated at Warsaw, which he bravely defended. Born, 1745; died, 1817.

Kossuth, Louis. Hungarian orator and patriot. Leading spirit in the insurrection of 1848-49; effected many important reforms. Born, 1802; died, 1894.

Kropotkine, Prince Peter. Russian Nihilist. Arrested in Russia and escaped; imprisoned in France. Wrote *Paroles d'un Revolte*, *In Russian and French Prisons*. Born, 1842.

Kruger, Stephanus Johannes Paul. President of the South African Republic after 1883. Declared war against England in 1899. Went for aid to Europe in 1900. Born, 1825.

La Fayette, Marie J. P. R. P. Gilbert Motier, Marquis de. Joined American army as major-general, 1777; commanded advance guard of Washington at Yorktown; commander of French national guard, 1789; revisited America, 1824; took part in revolution of 1830. Born, 1757; died, 1834.

Lamarck, Jean Baptiste de. French naturalist. Famous for his theory of animal evolution. *Philosophie Zoologique*. Born, 1744; died, 1829.

Lamb, Charles. English author and humorist. *Essays of Elia*; *Essays on Tragedies of Shakespeare*, etc. Born, 1775; died, 1834.

Landseer, Sir Edwin. English painter. *The Old Shepherd's Chief Mourner*. Born, 1802; died, 1873.

Laplace, Pierre Simon, Marquis of. Great French mathematician and astronomer. Discovered the theory of Jupiter's satellites and the causes of the acceleration of the moon's mean motion, and of the inequality of Jupiter and Saturn. His *Exposition of the System of the universe* is a popular form of his great work *La Mecanique Celeste*. He was one of the greatest mathematicians and astronomers. Born, 1749; died, 1827.

Latimer, Hugh, Bishop of Worcester. English reformer. Burned. Born, 1480; died, 1555.

Laurier, Sir Wilfred. Canadian Premier after 1896. The First French Canadian to attain the honor. Elected in 1871 as a Liberal to the Quebec Provincial Assembly; in 1874 to the Federal Assembly. He stood first among the Colonial representatives at Queen Victoria's Diamond Jubilee in 1897. Born, 1841.

Law, John. Scotch financier in France. Promoter of the "South Sea Bubble." Born, 1671; died, 1729.

Lawrence, James. American naval commander. Commander of the *Chesapeake*; killed fighting the British *Shannon*. "Don't give up the ship." Born, 1781; died, 1813.

Layard, Sir Henry Austin. Assyrian excavator. He made wonderful discoveries at the site of Nineveh, and wrote *Nineveh and its Remains*, etc. Born, 1817; died, 1894.

Lecky, William Edward Hartpole. English historian. *Rationalism in Europe*, *European Morals*, *England in the 18th Century*. Born, 1838.

Lebrun, Charles. French painter. *The Family of Darius*. Born, 1619; died, 1690.

Lebrun, Charles Francois, Duke of Placentia. French politician. Third consul; Governor-General of Holland. Born, 1739; died, 1824.

Lee, Arthur. American statesman and diplomatist. Member of Congress; Minister to France. Born, 1740; died, 1792.

Lee, Fitzhugh. American general, Confederate soldier, Consul-General to Cuba. Commanded a division in Cuba during reconstruction. Born, 1835.

Lee, Francis Lightfoot. American Revolutionary patriot. Member Congress; signed Declaration of Independence. Born, 1734; died, 1797.

Lee, Henry. American Revolutionary soldier. "Light Horse Harry." Served under Greene; Governor of Virginia. Born, 1756; died, 1818.

Lee, Richard Henry. American Revolutionary statesman. Signed Declaration of Independence; President of Congress; U. S. Senator. Born, 1732; died, 1794.

Lee, Robert Edward. American Confederate general. Commander-in-chief of Confederate army. Born, 1807; died, 1876.

Leibnitz, Godfrey William, Baron. German mathematician and philosopher. In 1676 he discovered the infinitesimal calculus, about which he had a bitter dispute with Newton. In his treatise *Protogæa* (1693) he anticipated many of the discoveries of modern geology. In his *New Essay on the Human Understanding* he opposes Locke. Born, 1646; died, 1716.

Leicester, Robert Dudley, Earl of. Favorite of Queen Elizabeth; commander of the English contingent in the Netherlands. Born, 1532; died, 1588.

Lely, Sir Peter. German portrait painter in England. Painter to Charles II. Born, 1617; died, 1680.

Leonidas. King of Sparta. Leader of the Three Hundred at Thermopylæ. Born, B. C. —; died, 480.

Leopold, I. Surnamed *The Great.* Emperor of Germany; waged fierce wars with the Turks for a long period of years, beginning in 1664. His last great battles were in Italy, and his troops played an important part in the decisive battle of Blenheim, 1704. Born, 1640; died, 1705.

Le Sage, Alain Rene. French novelist. *Gil Blas.* Born, 1668; died, 1747.

Lessing, Gotthold Ephraim. German critic and poet. *Laocoon; Nathan the Wise.* Born, 1729; died, 1781.

Lever, Charles. Irish novelist. *Charles O'Malley, Harry Lorrequer.* Born, 1806; died, 1872.

Li Hung-Chang. Chinese statesman. He aided Gordon in suppressing the Taiping rebellion; made governor-general of Chang, 1864; of Chi-li, 1872; founded the Chinese navy; commander-in-chief in the war with Japan, 1894; made treaty of peace; visited Europe and America 1896; selected to deal with the western powers after the Boxer outbreak of 1900. Born, 1828.

Lincoln, Abraham. President of the United States, 1861–1865. Born in Kentucky; afterwards removed to Illinois; captain in Black Hawk War; admitted to Illinois bar, 1836; Whig M. C., 1846; unsuccessful candidate for Senator against Douglas, 1856; elected President, 1860; re-elected, 1864; assassinated by J. Wilkes Booth, April 14, 1865; died April 15. Born, 1809; died, 1865.

Lind, Jenny. Celebrated Swedish singer. At 16 years the favorite opera singer of her native land; toured the world with marvelous success. Born, 1821; died, 1887.

Linnæus, Charles von. German botanist. Studied medicine and natural history. *System of Nature, Genera of Plants; Philosophia Botanica, Species Plantarum.* Designated each species of plants by adding single epithet to name of genus. Born, 1707; died, 1778.

Liszt, Franz Celebrated Hungarian pianist. Born, 1811; died, 1886.

Livingstone, David. African explorer. *Narrative of an Expedition to the Zambesi.* Born, 1817; died, 1873.

Livy. (Titus Livius.) Roman historian. Famous for the rare style of his *History of Rome.* Born, B. C. 59; died, A. D. 17.

Locke, John. English philosopher. *Human Understanding.* Born, 1632; died, 1704.

Longfellow, Henry Wadsworth. American poet. *Hyperion, Ballads and other Poems, The Spanish Student, The Belfry of Bruges, Evangeline, The Golden Legion, Hiawatha, Miles Standish, Tales of a Wayside Inn.* Born, 1807; died, 1882.

Louis XIV. King of France. Son of Louis XIII. and Anne of Austria. Fought England, Austria, Spain, and Belgium, and engaged in the war of the Spanish Succession; was a patron of literature and the arts. Born, 1638; died, 1715.

Louis XVI. King of France. Married Marie Antoinette, 1770; succeeded Louis XV., 1774; imprisoned by the revolutionists; guillotined. Born, 1754; died, 1793.

Louis Philippe. King of France. "The citizen king." Abdicated in 1848. Born, 1773; died, 1850.

Lowell, James Russell. American poet, critic and diplomatist. *The Bigelow Papers, The Vision of Sir Launfal, The Commemoration Ode, Fable for Critics, The Cathedral, Among my Books, My Study Windows.* Minister to Spain and England. Born, 1819; died, 1891.

Loubet, Emile. President of France. He studied the law; was elected deputy in 1876; Senator in 1885; became Premier in 1892; President of the Senate in 1896, and succeeded M. Faure as President of the Republic of France in 1899. Born, 1839.

Loyola, Ignatius. He founded the Society of Jesus, with the object of renovating the Church and converting the infidels; left a devotional work called *Spiritual Exercise.* Born, 1491; died, 1536.

Lubbock, Sir John. English banker and naturalist; member Parliament. *The Origin of Civilization.* Born, 1834.

Lucian. Greek essayist and satirist. Famous for his delightful style and fine humor. *Dialogues of the Dead; True Histories.* Born, 125; died, 180.

Luther, Martin. German reformer. Became a priest in 1507; published (1517) ninety-five propositions against indulgences; burnt the Pope's Bull at Wittenburg. Justification by faith was the central point of his theology. Born, 1483; died, 1546.

Lycurgus. Spartan legislator. Instituted community of property and double executive at Sparta in the 9th century. Born, B. C. 850; died, —.

Lyell, Sir Charles. English geologist. Founded the uniformean theory of geology. *Principles of Geology.* Born, 1797; died, 1875.

Lyttelton, Sir Thomas. English lawyer and judge. *Tenures.* Born, 1420; died, 1481.

Lytton, Sir Edward G. E. Lytton Bulwer, Baron. English novelist and dramatist. *The Caxtons; Richelieu.* Born, 1805; died, 1873.

Lytton, Lord Edward Robert Bulwer. ("Owen Meredith.") English statesman and novelist. *Lucille.* Born, 1831.

Macaulay, Thomas Babington, Lord. English historian and essayist. *History of England, Essays, Lays of Ancient Rome.* Born, 1809; died, 1859.

Maclaren, Ian (*nom de plume* of Rev. John Watson). Was minister of the Free Church in Logiealmond, and in Glasgow and Liverpool. *Beside the Bonnie Briar Bush,* etc. Born, 1850.

Macdonald, Sir John Alexander. Regarded as Canada's greatest statesman; organizer of the first government of the Dominion and its first Prime Minister. Born, 1815; died, 1891.

MacMaster, John Bach. American historian. Professor American history, University of Pennsylvania. *History of the People of the United States*, etc. Born, 1852.

McCarthy, Justin. An Irish author and statesman. Leader of his party in House in Parliament, 1890 to 1896. *A History of Our Own Times*, *History of the Four Georges*, and a number of popular novels. Born, 1830.

McClellan, George B. American general. Won battle of Antietam in the Civil War. Born, 1826; died, 1885.

McKinley, William. American statesman; served in the Civil War; entered Congress in 1877; passed in 1890 a tariff measure named after him; was elected to the U. S. Presidency as the champion of a sound currency in opposition to Mr. Bryan in November, 1896, and again in November, 1900. Born, 1844 ; assassinated, 1901.

Madison, James. American President. Member of the Virginia Legislature, of the convention of 1787, and a strenuous advocate of the Constitution; joint author with Hamilton and Jay of the *Federalist;* M. C., 1789–97; Secretary of State, 1801–9; President, 1809–17. Born, 1751; died, 1836.

Magellan, Ferdinand de. Portuguese navigator. Magellan's Straits is named after him. Born, 1470; died, 1521.

Mahan, Alfred Thayer. An American naval officer and writer. *Influence of Sea Power upon History.* Born, 1840.

Mahomet. Arabian prophet. Founder of Mohammedanism. When 40 years of age, receiving a pretended revelation from Allah, he devoted himself to the propagation of a new religion. His faith was rejected at Mecca, but taken up at Medina. He fled from Mecca 622 (The Hegira); was originally a monogamist, and at first asserted liberty of conscience. Born, 570; died, 632.

Mandeville, Sir John. English traveler in the East. Often called the first English prose writer. Born, 1300; died, 1372.

Mann, Horace. American educationist. Member of Congress; President of Antioch College. Anti-slavery advocate. Born, 1796; died, 1859.

Marat, Jean P. French Revolutionist. Assassinated. Born, 1744; died, 1793.

Marconi, Guglielmo. Italian electrician. Discovered a practical system of telegraphing without wires. Born, 1875.

Maria Theresa. Empress of Austria and Queen of Hungary. Her husband, Francis, Duke of Lorraine, was chosen Emperor in 1745, but she was the real power; took part in the Seven Years' War; abolished feudal service. Born, 1717; died, 1780.

Marion, Francis. American general and patriot. Noted for his guerilla warfare against the British during the Revolutionary war. Born, 1732; died, 1795.

Marlborough, John Churchill, Duke of. English commander. Made Earl of Marlborough, 1689; commanded English forces in Low Countries, 1689; deposed for his Jacobite intrigue, 1692; restored, 1696; commander of allied armies in Holland, 1702; won battle of Blenheim, 1704; Ramillies, 1706; Malplaquet, 1709. His wife was the confidante of Queen Anne. In disgrace from 1711 till accession of George I. Born, 1650; died, 1722.

Marlowe, Christopher. English poet and dramatist. Born, 1564; died, 1593.

Marshal, John. Chief Justice of the United States. Captain in the Revolutionary War, at the close of which he began to practice law in Virginia; a member of the Virginia Convention (1788); in 1797, with Pinckney and Gerry, he went on a diplomatic mission to France; elected to Congress in 1799; appointed Secretary of State 1800, and resigned that office to become Chief Justice. Was the greatest judge that ever held the latter office. Born, 1755; died, 1835.

Maartens, Maarten. Dutch novelist. Wrote in English *God's Fool*, *My Lady Nobody*, etc. Born, 1858.

Mary. Queen of England. Married Philip II. of Spain. Persecutor of the Protestants. Born, 1516; died, 1558.

Mary Stuart. Queen of Scots. Daughter of James V. Was invited to the throne of Scotland (1560.) Compelled to take refuge in England, she was finally beheaded by Elizabeth on a charge of conspiracy. Born, 1542; died, 1587.

Mathew, Theobald. "Father Mathew." Irish temperance reformer. Born, 1790; died, 1856.

Mazzini, Guiseppe. Italian patriot. Co-operated with Garibaldi; founder of Young Italy. Born, 1808; died, 1872.

Meade, George G. American general. Won battle of Gettysburg. Born, 1815; died, 1872.

Medici, Catherine de'. Queen of Henry II. of France. Instigated massacre of St. Bartholomew. Born, 1519; died, 1589.

Medici, Lorenzo de'. Grand Duke of Florence. "The Magnificent." Patron of art and literature; adorned Florence. Born, 1448; died, 1492.

Meissonier, Jean Louis Earnest. French painter. Distinguished for his highly finished small works. *The Chess Players; Freedland or 1807.* Born, 1813; died, 1891.

Mendelssohn-Bartholdy, Felix. German composer. Among his most famous works are his *Songs Without Words.* Born, 1809; died, 1847.

Mesmer, Frederick B. Suabian physician. Founder of Mesmerism. Born, 1731; died, 1815.

Meyerbeer, James. German composer. *Romilda e Costanza*, 1818; *Semiramide Riconosciula*, 1819; *Crociato in Egypto*, 1824; *Robert le Diable*, 1831; *Huguenots*, 1836; *L'Etoile du Nord*, 1854. Born, 1791; died, 1864.

Mezzofanti, Guiseppe G., Cardinal. Italian linguist. Born, 1774; died, 1849.

Michael Angelo (Buonarotti). Italian painter, sculptor, and architect. Painted the fresco of the *Last Judgment*, and prophets, sibyls, etc., at the Sistine Chapel. Among his great sculptures are the gigantic marble *David* and *Moses;* was appointed architect of St. Peter's, and formed a model for the dome; wrote sonnets and poems. Born, 1474; died, 1564.

Miles, Nelson A. American General-in-chief of the United States army in Spanish War. Received surrender of Porto Rico. Won fame in Civil War. Captured Jefferson Davis. Born, 1839.

Mill, John Stuart. English political economist and philosopher. *Logic*, *Political Economy*, *Examination of Sir W. Hamilton's Philosophy*. Born, 1806; died, 1873.

Millais, Sir John E. English painter. *Return of the Dove to the Ark*. Born, 1829; died, 1896.

Miller, Hugh. Scotch geologist. *Old Red Sandstone*. Born, 1802; died, 1856.

Miltiades. Athenian general. Commander at Marathon. Flourished 500 B. C.

Milton, John. English poet. *Paradise Lost*. Wrote many prose, political and controversial works. His sonnets are among the best in the language. His other works are *Comus*, *L'Allegro*, *Il Penseroso*, *Samson Agonistes*, *Paradise Regained*, *Lycidas*. Born, 1608; died, 1674.

Mirabeau, Gabriel H. de Riquetti, Count of. French orator and revolutionist. Entered army, 1767; imprisoned by his father at various times for intrigues and debts; president of National Convention, 1791. Born, 1749; died, 1791.

Mitchell, Donald G. ("Ik. Marvel.") American author. *My Farm at Edgewood; Reveries of a Bachelor*. Born, 1822.

Mithridates. "The Great." King of Pontus. With Tigranes of Armenia he fought the Romans for many years. Born, B. C. 130; died, 63.

Moltke, Hillmuth, Count von. German general. Conqueror in the Franco-Prussian war. Born, 1800; died, 1891.

Monroe, James. American President. Captain in Revolutionary War; studied law with Jefferson; delegate to Congress, 1783; opponent of Constitution; Senator, 1790; Minister to France, 1794–6; Governor of Virginia, 1799–1802; Envoy-Extraordinary to France, 1802; Minister to England, 1803; Governor of Virginia, 1811; Secretary of State, 1811–17; President, 1817–25. Born, 1758; died, 1831.

Montcalm, Louis J. de St. Véran, Marquis of. French commander in Canada. Killed on Abraham's Heights, in the battle with Wolfe. Born, 1712; died, 1759.

Montesquieu, Charles de Secondat, Baron de. French author. *Spirit of the Laws*. Born, 1689; died, 1755.

Montezuma II. Last Emperor of Mexico. Mortally wounded while attempting to quell insurrection of his subjects against Cortez. Born, 1470; died, 1520.

Moody, Dwight Lyman. Evangelist. Associated with Mr. Sankey; visited Great Britain in 1873 and 1883. Born, 1837; died, 1900.

Moore, Thomas. Irish poet. *Lalla Rookh*, *Irish Melodies*, *The Epicurean*, *Life of Sheridan*, *Life of Lord Byron*. Born 1779; died, 1852.

More, Sir Thomas. English statesman and author. Lord Chancellor; became favorite of Henry VIII.; published *Utopia*, 1516; speaker of House of Commons, 1523; Lord Chancellor, 1532; refused to acknowledge the validity of Henry's marriage to Anne Boleyn. Born, 1480; died, 1535.

Morris, Gouverneur. American Revolutionary statesman and orator. Minister to France; United States Senator; promoter of Erie Canal. Born, 1754; died, 1816.

Morris, Robert. American financier and statesman. Aided the Government with funds in the Revolution; Superintendent of Finances, 1781–4; imprisoned for debt. Born, 1734; died, 1800.

Morris, William. English poet and artistic designer of household decorations. *The Earthly Paradise*, *News from Nowhere*, etc. Born, 1834; died, 1896.

Morse, Samuel Finley Breese. American inventor of telegraph. Constructed small recording electric telegraph in 1835; constructed telegraph line from Washington to Baltimore, and brought telegraph into successful operation in 1846. Born, 1794; died, 1872.

Motley, John Lothrop. American historian and diplomatist. Minister to England and Austria. *The Rise of the Dutch Republic*. Born, 1814; Died, 1877.

Mozart, Johann. German composer. *The Marriage of Figaro*, *Don Giovanni*, *The Magic Flute*. His latest work, the *Requiem*, is his most sublime. Born, 1756; died, 1791.

Muller, F. Max. German philologist in England. *Chips from a German Workshop*. Born, 1833; died, 1900.

Murat, Joachim. French Marshal and King of Naples. Dashing cavalry leader. Born, 1770; died, 1815.

Murillo, Bartholomew Stephen. Spanish painter. His virgin saints and his beggar boys are famous. Among his great works are *St. Elizabeth of Hungary*, *The Prodigal Son*, *The Young Beggar*, *Moses Striking the Rock*, *St. Anthony of Padua*, and the *Marriage of St. Catherine*. Born, 1618; died, 1682.

Nansen, Fridtiof. Norwegian Arctic discoverer. Made his first journey across Greenland in 1888; set out in 1893 in the *Fram*, to drift to the pole; reached in 1895 86° 14′ north latitude, the highest then attained. Wintered in Franz Joseph Land; rescued in 1896. *The First Crossing of Greenland*, *Farthest North*. Born, 1861.

Nelson, Horatio, Viscount. English naval commander. Went to sea at thirteen; post captain, 1779; rear admiral, 1797; won battle of the Nile, 1798; second in command at Copenhagen, 1801, (but really won the fight); in 1805, with twenty-seven sail of the line and four frigates, defeated combined French and Spanish fleets at Trafalgar, where he was mortally wounded. Born, 1758; died, 1805.

Nero. Roman Emperor (54-68). Put his mother to death; persecuted Christians; said to have burned Rome. Born, 37; died, 68.

Newcomb, Simon. American astronomer. Conducted the American *Nautical Almanac*. Wrote much on astronomy. Born, 1835.

Newman, John Henry, Cardinal. English Catholic theologian. Born, 1801; died, 1840.

Newton, Sir Isaac. English mathematician and philosopher. His great work, the *Principia*, appeared in 1687. In this he shows that every particle of matter is attracted by every other particle with a force inversely proportional to the squares of the distances. Born, 1642; died, 1727.

Ney, Michael. "The Bravest of the Brave." One of Napoleon's marshals. Led Guard at Waterloo; shot by order of Louis XVII. Born, 1769; died, 1815.

Nicholas I. Czar of Russia. Warred with Turkey and Persia; put down Polish insurrection; engaged in Crimean War. Born, 1796; died, 1855.

Nicholas II. Czar of Russia. Son of Alexander III., and his successor in November, 1894. Married Princess Alice, granddaughter of Queen Victoria. Born, 1868.

Nightingale, Florence. English philanthropist. *Notes on Nursing.* Born, 1820.

Nobel, Alfred. Danish manufacturer. Discovered how to make dynamite. Left $10,000,000, most of it to go for annual prizes for important scientific discoveries, best literature, and best work in the cause of humanity. Born, 1833; died, 1896.

Nordenskjöld, Baron Nils Adolf Erik. Swedish explorer. In 1878-79 he made the first voyage from the Atlantic to the Pacific, north of Asia. *Voyage of the Vega.* Born, 1832.

Oates, Titus. English informer; inventor of the "Popish Plot." Born, 1620; died, 1705.

O'Connell, Daniel. Irish orator and agitator; advocate of Catholic Emancipation, and the repeal of the union. Born, 1775; died, 1847.

Oersted, Hans C. Danish scientist; founder of the science of electro-magnetism. Born, 1775; died, 1851.

Oglethorpe, James. British general; colonizer of Georgia. Born, 1688; died, 1785.

Ohm, George Simon. German physicist. Discovered the mathematical theory of the electric current, known as Ohm's Law. Born, 1787; died, 1854.

Oliphant, Margaret. Authoress. She wrote on history, biography, and criticism; *The Makers of Florence, of Venice, of Modern Rome; Lives of Dante, Cervantes, and Edward Irving.* Born, 1828; died, 1897.

Origen. Greek Father of the Church. *Hexapla.* Held universal restoration of the dead. Born, 185; died, 253.

Otis, Harrison Gray. American statesman and orator. A Federalist leader in Congress. Born, 1765; died, 1848.

Otis, James. American Revolutionary statesman and orator. Argued against writs of assistance; led popular party. Born, 1726; died, 1783.

Outram, Sir James. English general in India. Led expedition against Persia, 1836. Born, 1802; died, 1863.

Ovid, (Publius Ovidius Naso). Roman poet. *Metamorphoses.* Born, B.C. 43; died, A. D. 18.

Paderewski, Ignace Jan. Celebrated pianist. Born at Podolia, in Russian Poland; master of his art by incessant practice from early childhood; twice visited the United States; a brilliant composer as well as performer. Born, 1860.

Paganini, Niccolo. Italian violinist; celebrated for his performances on a single string. Born, 1784; died, 1840.

Paine, Robert Treat. American lawyer and statesman. Signed Declaration of Independence. Born 1731; died, 1814.

Paine, Thomas. American (English born) deist and political writer. *The Age of Reason, Common Sense.* Born, 1737; died, 1809.

Paley, William. English divine and theologian. *Evidences.* Born, 1743; died, 1805.

Palissy, Bernard. French potter. Discovered the art of enamelling stoneware. *Treatise on the Origin of Fountains.* Born, 1510; died, 1596.

Palmerston, Henry John Temple, 3d Viscount. English statesman; Minister of Foreign Affairs; long Prime Minister. Born, 1784; died, 1865.

Park, Mungo. Scotch traveler in Africa. *Travels in the Interior of Africa.* Born, 1771; died, 1805.

Parker, Theodore. American theologian and reformer. *Transient and Permanent in Christianity.* Born, 1810; died, 1860.

Parkman, Francis. American historian. *Conspiracy of Pontiac, A Half Century of Conflict,* etc. Born, 1823; died, 1893.

Parnell, Charles Stewart. Irish politician and agitator; M. P.; head of the Land League movement. Born, 1847; died, 1891.

Parr, Catherine. Last Queen of Henry VIII. of England, whom she succeeded in surviving. Born, 1509; died, 1548.

Parton, James. Noted American biographer. Married sister of N. P. Willis, who, as "Fannie Fern," wrote many children's books. Born, 1822; died, 1891.

Pascal, Blaise. Illustrious French thinker and writer. Was distinguished at once as a mathematician, a physicist, and a philosopher. Born, 1623; died, 1662.

Pasteur, Louis. French bacteriologist. He discovered the origin of fermentation, the silk-worm disease, splenic fever, etc., to be due to micro-organisms, and founded the germ theory of disease. Born, 1822; died, 1895.

Patrick, Saint. Apostle of Ireland. Born in Scotland. One of the first to preach Christianity in Ireland. Born, 372; died, 463.

Paul, Saint, of Tarsus. Apostle of the Gentiles. Born, —; died, 65.

Payne, John Howard. American dramatist and poet. *Home, Sweet Home.* Born, 1792; died, 1852.

Peabody, George. American banker in London; philanthropist. Founder of homes for workingmen in London, of museums, etc. Patron of education. Born, 1795; died, 1869.

Peary, Robert. American Arctic discoverer. He made three journeys to the far North; crossed northern Greenland in 1891 and 1894, and was in the polar regions in 1901. Born, 1856.

Peel, Sir Robert. English statesman and Prime Minister. Repealed the Corn Laws. Born, 1788; died, 1850.

Penn, William. Founder of Pennsylvania. The son of Admiral Penn, born in London; was converted to Quakerism while a student at Oxford. His father's death brought him a fortune and a claim upon the Crown, which he commuted for a grant of land in North America, where he founded

(1682) Pennsylvania. Here he established a refuge for all persecuted religionists, and, laying out Philadelphia as the capital, governed his colony wisely and generously for two years. He returned to England, where his friendship with James II. brought many advantages to the Quakers, but laid him under harassing and undeserved prosecutions for treason in the succeeding reign. The closing years of his life were clouded by mental decay. Born, 1644; died, 1718.

Pericles. Athenian orator and statesman. Came forward as a leader of the democracy 470 B. C. He secured the ostracism of Cimon, and after that event, and the ostracism of Thucydides, was the first man in Athens. He greatly increased the influence of Athens, which he adorned with noble public works. Born, B. C. —; died, 429.

Perry, Matthew C. American commodore. Chief of expedition to Japan. Born, 1795; died, 1858.

Perry, Oliver H. American naval commander. Won battle of Lake Erie. Born, 1785; died, 1820.

Pestalozzi, Giovanni H. Swiss educator. *Leinhard und Gertrude.* Born, 1746; died, 1827.

Peter the Hermit. Preacher of the First Crusade. Born, 1050; died, 1115.

Peter I. ("The Great.") Czar of Russia. Visited Western Europe in 1697; was for a time a ship-carpenter in Holland, and spent eight months in England; on his return to Russia, he reorganized the army and navy, founded schools, and took measures to increase Russian commerce; he made an alliance with Poland and Denmark, (1701) against Charles XII., whom he defeated at Pultowa (1709); founded St. Petersburg (1703). Born, 1672; died, 1725.

Petrarch, Francis. (Francesco Petrarca.) Italian poet and scholar. *Sonnets.* Born, 1304; died, 1374.

Phidias. Greatest of Greek sculptors. His masterpieces were the colossal ivory-and-gold statues (forty feet high) of Minerva at the Parthenon, and of Zeus at Olympia in Elis; the latter being counted one of the wonders of the world. Born, B. C. 490; died, 432.

Philip II. King of Macedonia. Father of Alexander the Great. Assassinated. Born, B. C. 382; died, 335.

Philip II. ("Augustus.") King of France. Annexed Normandy, Anjou, Lorraine; won battle of Bouvines. Born, 1165; died, 1223.

Philip IV. ("The Fair.") King of France. Suppressed the Templars; imprisoned Pope Boniface III. Born, 1268; died, 1314.

Philip II. King of Spain. Son of Charles V. Caused revolt in Netherlands; despatched Armada against England. Born, 1527; died, 1598.

Phillips, Wendell. American orator, Abolitionist. *Speech in Faneuil Hall*, 1836. Born, 1811; died, 1884.

Pierce, Franklin. American President. Born in New Hampshire; studied law; Democratic member Congress, 1832–37; U. S. Senator, 1837–42; brigadier-general in Mexican War; President, 1853–57; opposed coercion of seceding States. Born, 1804; died, 1869.

Pindar. Lyric poet of Thebes. *Odes.* Born, B. C. 518; died, 442.

Pisistratus. Tyrant of Athens. Patron of learning. Said to have had *Iliad and Odyssey* reduced to writing for the first time. Born, B. C. 612; died, 527.

Pitt, William. English statesman and orator; the second son of Lord Chatham. Entered Parliament in 1781; Chancellor of the Exchequer, 1782; First Lord of the Treasury, and Prime Minister, 1783; resigned in 1801, but took office again in 1804; was the head and front of the great coalition against Bonaparte. Born, 1759; died, 1806.

Pius IX. (Giovanni Maria Mastai Ferretti). Pope. Dogmas of Immaculate Conception and Papal Infallibility promulgated during his incumbency; temporal power lost 1870. Born, 1792; died, 1878.

Pizarro, Francis. Spanish conqueror of Peru. Born, 1475; died, 1541.

Plato. Greek philosopher and writer. Among his works are *The Republic*, *Phædo*, *Gorgias*, *Crito*, and *Apology for Socrates.* Born, B. C. 428; died, 347.

Pliny, The Elder. Roman savant and writer. *Natural History.* Born, 23; died, 79.

Pliny, The Younger. Roman writer and statesman. *Panegyric on Trajan.* Born, 61; died, 106.

Plutarch, Greek biographer. *Lives.* Born, 45; died, 120.

Poe, Edgar Allen. American poet. *The Raven.* Born, 1811; died, 1849.

Polk, James K. American President. Born in North Carolina; removed to Tennessee, 1806; studied law; member of Congress, 1825; elected speaker, 1835 and 1837; governor of Tennessee, 1839–41; Democratic President, 1845–49; prosecuted Mexican War. Born, 1795; died, 1849.

Polk, Leonidas, Bishop. American Confederate general and Episcopal prelate. Conspicuous at Shiloh and Stone River. Born, 1806; died, 1864.

Polo, Marco. Venetian traveler in the East. *The Book of Marco Polo.* Born, 1256; died, 1333.

Pompey (Cnæus Pompeius). Roman general and statesman. Conqueror of Spain and victor over Mithridates; leader of aristocracy; rival of Cæsar; defeated at Pharsalia. Born, B. C. 106; died, 48.

Ponce de Leon, Juan. Spanish discoverer of Florida. Born, 1460; died, 1521.

Pope, Alexander. English poet. *Pastorals*, *Essay on Criticism*, *Essay on Man*, etc. Born, 1688; died, 1744.

Porter, David. American naval officer. Commander of the *Essex*. Born, 1780; died, 1843.

Porter, David D. American naval officer. Admiral; bombarded Fort Fisher. *History of the Navy in the Rebellion.* Born, 1813; died, 1887.

Porter, Noah. American philosophical writer. President of Yale. *Human Intellect.* Born, 1811.

Prescott, William Hickling. American historian. *Ferdinand and Isabella*, etc. Born, 1796; died, 1859.

Ptolemy I. ("Soter.") King of Egypt. Founder of the dynasty of Greek sovereigns in Egypt; patron of literature. Born, B. C. 367; died, 282.

Ptolemy II. ("Philadelphus") King of Egypt.

Founder of Alexandrian Library; Theocritus, Euclid, Aratus lived at his court. Born, B. C. 309; died, 247.

Ptolemy, Claudius. Greek mathematician and geographer. *Almagest.* Lived from about 100 to 160.

Pulaski, Count. Polish general in the American Revolution. Leader of "Pulaski's Legion;" killed at siege of Savannah. Born, 1747; died, 1779.

Putnam, Israel. General in the American Revolution. Conspicuous at Bunker Hill. Born, 1718; died, 1790.

Pyrrhus. King of Epirus. Defeated the Romans; conquered Macedonia; one of the greatest generals of antiquity. Born, B. C. 318; died, 272.

Pythagoras. Greek philosopher and writer. Taught doctrine of transmigration of souls. Born, B. C. 570; died, 510.

Quincy, Josiah. American statesman and author. Federalist member of Congress. *History of Harvard University.* Born, 1772; died, 1864.

Quincy, Josiah, Jr. American Revolutionary patriot and orator. *Observations on the Boston Port Bill.* Born, 1744; died, 1775.

Rabelais, Francois. French satirist and scholar. Joined Franciscans, but left the order. His great work is *The Pleasant Story of the Giant Gargantua and his Son Pantagruel.* Born, 1495; died, 1553.

Racine, Louis. French dramatist. Among his best works are the comedy *Les Pladeurs* (The Litigants), and the tragedies *Britannicus, Iphigenie, Phidre,* and *Athalie.* Born, 1639; died, 1699.

Raleigh, Sir Walter. English courtier, statesman, and author. *History of the World.* A favorite of Queen Elizabeth; executed by James I. Born, 1552; died, 1618.

Randolph, John, of Roanoke. American politician. Member of Congress; Minister to Russia; opposed Missouri Compromise; caustic wit. Born, 1773; died, 1833.

Raphael, (Raffaele Sanzio) of Urbino. Italian painter. *Sistine Madonna.* Among his other works are the frescoes called *The School of Athens, The Transfiguration, The Marriage of the Virgin, Galatea,* and the cartoons (designs for tapestry of the Pope's Chapel). Born, 1483; died, 1520.

Read, Thomas Buchanan. American poet and artist. *The Wagoner of the Alleghanies.* Born, 1822; died, 1872.

Reed, Thomas B. Distinguised American Congressman and Speaker of the House. A public speaker of note. Born, 1839.

Renan, J. Ernest. French Orientalist and author. *Life of Jesus.* Born, 1823; died, 1892.

Revere, Paul. American Revolutionary patriot. Carried to Concord news of impending attack of Gage. Born, 1735; died, 1818.

Reynolds, Sir Joshua. English painter. *Mrs. Siddons as the Tragic Muse.* Born, 1723; died, 1792.

Rhodes, Cecil John. English adventurer. He became chief owner of the South African diamond mines; Prime Minister of Cape Colony in 1890; and chief settler of "Rhodesia." Was accused of fomenting the war with the Transvaal; projected a railroad from Cape Town to Cairo. Born, 1853.

Richard I. (Cœur de Lion.) King of England. Conquered Acre; defeated Saladin. Born, 1157; died, 1199.

Richard III. King of England. Put Edward V. to death and usurped his crown; killed at Bosworth. Born, 1452; died, 1485.

Richardson, Samuel. English novelist. *Clarissa Harlowe, Sir Charles Grandison, Pamela.* Born, 1689; died, 1761.

Richelieu, Armand Jean Duplessis, Cardinal. French statesman. Made Cardinal, 1622; Prime Minister, 1624; secured exile of his foe, Marie de Medicis, 1630; reduced the Huguenots and captured Rochelle; supported German Protestants against Austria; founded French Academy (1635); added Alsace, Lorraine, and Roussillon to France. Born, 1585; died, 1642.

Richter, John Paul Frederich (Jean Paul). German novelist. *Thorn, Fruit, and Flower Pieces.* Born, 1763; died, 1825.

Rienzi, Nicolo Gabrini. Italian patriot and enthusiast. Tribune; for a short time ruler of Rome: "the friend of Petrarch, hope of Italy." Born, 1313; died, 1354.

Roberts, Lord Frederick. The hero of Kandahar (1880). Commander-in-chief of British forces in Boer War, South Africa, 1899–1900. Succeeded Lord Wolseley as commander-in-chief, and was made an earl. Born, 1832.

Robert I. (Bruce.) King of Scotland. Conquered Scotland from the English. Born, 1276; died, 1329.

Robespierre, Francois J. M. French Revolutionist. Leader of the extreme radicals; ruler during the Reign of Terror; guillotined. Born, 1759; died, 1794.

Rosebery, Archibald Philip Primrose, Earl of. English statesman; Prime Minister, 1894–1895. Born, 1847.

Roentgen, William Konrad von. German physicist. He discovered in 1895 the X-rays or Roentgen-rays. Born, 1845.

Rockefeller, John D. American capitalist; President Standard Oil Company. A man of immense wealth; gave largely to Chicago University. Born, 1840.

Roland, Madame Manon J. P. French Republican and writer. *Memoirs.* Guillotined. Born, 1754; died, 1793.

Roosevelt, Theodore. Vice President of the United States with McKinley. Graduated Harvard, 1880; entered New York Legislature, 1882; appointed head of Civil Service Commission by President Harrison, 1889, and again by Cleveland, 1893; Commissioner police in New York, 1895; Assistant Secretary of Navy, 1897; Hero "Rough Riders" Spanish War, 1898; Governor of New York, 1899; elected Vice-President, 1900. Born, 1858. Succeeded to the Presidency, Sept. 14, 1901.

Rothschild, Meyer Amschel. Famous banker.

The founder of the Rothschild house, born at Frankfort-on-the-Main, a Jew by birth; began his career as a money lender and made a large fortune. Born, 1743; died, 1812.

Rubens, Peter Paul. Dutch painter. *Descent from the Cross*, *Last Judgment*, *Battle of the Amazons*, *Judgment of Paris*, *Rape of the Sabines*. Born, 1577; died, 1646.

Ruskin, John. English art critic. *Modern Painters*. Born, 1819; died, 1900.

Salisbury, Robert Arthur Talbot Gascoigne Cecil, Marquis of. English statesman. Entered the House of Lords as Lord Salisbury in 1867; became Secretary for Foreign Affairs in 1881, and, on the death of Beaconsfield, leader of the Conservative party; he was three times raised to the Premiership, the last time on Lord Rosebery's retirement in 1896. Born, 1830; d., 1903.

Sampson, William T. American Rear Admiral. Commanded United States fleets Atlantic squadron, during Spanish War. Born 1840. D. 1902.

Savonarola, Girolamo. Italian reformer. A Dominican monk and preacher; denounced the corruptions of the Church; deserted by his followers; put to death. Born, 1452; died, 1498.

Schiller, John C. F. von. German dramatist and poet. Studied law and medicine, but finally followed his own inclination to literature. *The Robbers*, *Thirty Years' War*, *Wallenstein*, *Mary Stuart*, *William Tell*, etc.

Schley, Winfield Scott. Rear Admiral American Navy. Rescued Greeley Expedition, 1884. Commanded in naval victory over Spanish fleet at Santiago, 1898. Born, 1839.

Schubert, Francis. German composer. His Songs (*Lieder*) and Ballads are his best work; musical, tender, and expressive in the rarest degree. Born, 1797; died, 1828.

Schurz, Carl. American journalist and politician. Sec. Interior, 1877-1881. Born, 1829; d., 1906.

Scott, Sir Walter. Scotch novelist, poet and historian. *Waverley* novels; *Marmion*, *Lay of the Last Minstrel*, *The Lady of the Lake*, *Rokeby*, *The Vision of Don Roderick*. Son of an Edinburgh writer to the signet; lived at Abbotsford; ruined by commercial speculation. Born, 1771; died, 1832.

Scott, Winfield. Eminent American general. Prominent service in the War of 1812 against the British; received gold medal from Congress, and was promoted to major-general; 1841, made commander-in-chief of the United States army; 1847, assumed command in Mexico; received surrender of the City of Mexico; defeated for presidency by Franklin Pierce; made lieutenant-general. Born, 1786; died, 1866.

Selkirk. Alexander. Scotch sailor. His adventures suggested *Robinson Crusoe*. Lived alone on Juan Fernandez, 1694–1709. Born, 1675; died, 1723.

Seward, William H. American Republican statesman. Secretary of State, 1861–69. Born, 1801; died, 1872.

Shafter, William Rufus. American General. Defeated Spanish General Torrel, and received surrender of Spanish army at Santiago, Cuba, 1898. Born, 1835.

Shakespeare, William. Greatest English poet and dramatist. *Lear*, *Hamlet*, *Macbeth*, *Othello*, *The Tempest*, *Midsummer Night's Dream*; born at Stratford-on-Avon; married Anne Hathaway, 1582; produced the poems *Venus and Adonis*, and the *Rape of Lucrece*, 1593–94, the only works published under his own hand; first collected edition of works appeared in 1623. Born, 1564: died, 1616.

Shelley, Percy Bysshe. English poet. *Cenci*, *Adonais*, *Prometheus*, *Revolt of Islam*, *Alastor*, *The Witch of Atlas*; was drowned off coast of Italy. Born, 1792; died, 1822.

Sheridan, Philip H. American general. Won battles of Winchester, Cedar Creek, Five Forks. Born, 1831; died, 1888.

Sherman, John. American politician and financier. Secretary of the Treasury, 1877–81; Secretary of State, 1897–98. Born, 1823; died, 1900.

Sherman, William Tecumseh. American general. Made the "March to the Sea," through Georgia. Born, 1820; died, 1891.

Sickles, Daniel Edgar. American general. Elected to Congress 1856; brigadier-general in Civil War, losing a leg at Gettysburg; Minister to Spain, 1869-73. In Congress, 1892-94. Born, 1822; died, 1901.

Simon, Jules. French statesman and author of numerous works. Born, 1841; died, 1896.

Smiles, Samuel, LL. D. Scotch editor and author. Among his books are *Self-Help*, *Character*, *Thrift*, *Life aud Labor*, and the *Biographies of Inventors*. Born, 1812; died, 1904.

Smith, Adam. Scotch political economist. *Wealth of Nations*. Born, 1723; died, 1790.

Smith, Joseph. Founder of the Mormon Church. Claimed to dictate the *Book of Mormon* from gold plates found in New York State; arrested and imprisoned in the jail at Carthage, Mo., where he was killed by a mob. Born, 1805; died, 1844.

Smith, John, Captain. English adventurer. Famous Governor of Colony of Virginia. *History of Virginia*. Born, 1579; died, 1631.

Smith, Sydney, Rev. English divine and wit. Projector of the *Edinburgh Review*, *Peter Plymley's Letters*. Born, 1771; died, 1845.

Socrates. Athenian philosopher. Teacher of Plato. Put to death for his radical opinions. Born, B. C. 468; died, 399.

Southey, Robert, English poet laureate. *Curse of Kehama*, *Madoc*, *Thalaba*, *Don Roderick*. Born, 1774; died, 1843.

Spencer,, Herbert. English philosopher. *System of Evolutionary Philosophy*. B., 1820; d., 1903.

Spinoza, Benedict. Dutch philosopher. *Ethics Demonstrated by a Geometric Method*. Born, 1632; died, 1677.

Stael, Anna M. L. G., Baroness de. French authoress. Opposed Napoleon and was banished. *Corinne*. Born, 1766; died, 1817.

Standish, Miles, Captain. Plymouth colonist and soldier. Born, 1584; died, 1656.

Stanley, Henry Morton. African explorer. Born in Wales; went as a boy to America; became a newspaper correspondent; in 1869 was sent by the New York *Herald* to Africa to "find Livingstone;" succeeded in 1871. Wrote *The Congo*, *In Darkest Africa*, etc. Born, 1841.

Stanton, Edwin McMasters. American statesman. Attorney-General of the United States under Buchanan; Secretary of War under Presidents Lincoln and Johnson. Became a Justice of the Supreme Court of the United States, 1869. Born, 1815; died, 1869.

Stanton, Elizabeth Cady. One of the first agitators of woman's rights in the United States, and a leading advocate, lecturer, and writer on this subject and other reforms. Born, 1816.

Stedman, Edmund Clarence. American poet, and banker. Aside from his original compositions, edited *Victorian Poets*, *American Poets*, *Library of American Literature*. Born, 1833.

Stephens, Alexander H. American statesman. Vice-President of the Southern Confederacy. Born, 1812; died, 1883.

Stephenson, George. English inventor of the locomotive. In 1814 constructed a locomotive which drew eight cars; invented the steam blast pipe, and greatly improved the construction of the railroad; finally built an engine running thirty-five miles an hour. Born, 1781; died, 1848.

Stephenson, Robert. English inventor of the tubular bridge. Born, 1803; died, 1859.

Sterne, Laurence. English writer. *Tristram Shandy*, *Sentimental Journey*. Born, 1713; died, 1768.

Stevenson, Robert Louis Balfour. English novelist. *Treasure Island* (1883) won him fame; died in the Samoan Islands, where he made his home. Born, 1850; died, 1894.

Stevenson, Adlai Ewing. American statesman. Vice-President of the United States, 1893–97, with Grover Cleveland. Nominated again in 1900, with William Jennings Bryan, but failed of election. Born, 1835.

Stewart, Alexander T. American millionaire merchant. Born, 1803; died, 1876.

Stockton, Francis Richard. American novelist, and writer of humorous and fantastic tales. *Rudder Grange* and *The Lady or the Tiger?* Born, 1834.

Story, Joseph. American jurist. Justice of the Supreme Court. *Commentaries on the Constitution*. Born, 1779; died, 1845.

Stowe, Harriet E. Beecher. *Uncle Tom's Cabin*. Born, 1812; died, 1896.

Strauss, David Friedrich. German rationalist. Originator of the mythical theory of the Scriptures; Professor of Divinity at Zurich. Author of *The Life of Jesus*, which caused a great sensation by its skepticism. Born, 1808; died, 1874.

Stuart, Gilbert C. American portrait painter. *Portrait of George Washington*. Born, 1756; died, 1828.

Sullivan, Sir Arthur. Noted English musical composer. Author of *Pinafore Pirates of Penzance*, and *Patience*. Born, 1844; died, 1900.

Sumner, Charles. American Republican statesman, orator, and Senator. *The Grandeur of Nations*. Born, 1811; died, 1874.

Swedenborg, Emanuel. Swedish religionist and naturalist. The central point of his theosophy is the correspondence of the natural and the supernatural. Born, 1689; died, 1772.

Swift, Jonathan. Irish divine and satirist. Entered Church; became Dean of St. Patrick's; *Tale of a Tub*, *Gulliver's Travels*. Born, 1667; died, 1745.

Talleyrand Perigord, Charles Maurice, Prince of. French diplomatist and wit. Minister of Foreign Affairs. Born, 1754; died, 1836.

Taney, Roger B. American jurist and Democratic statesman. Chief Justice of the United States. Born, 1777; died, 1864.

Taylor, Bayard. American traveler, novelist, poet. Translator of Goethe's *Faust; Prince Deucalion; Masque of the Gods; John Godfrey's Fortunes*. Born, 1825; died, 1878.

Taylor, Zachary. American President. Entered army in 1808; major-general in Mexican War; won battle of Buena Vista; elected President by the Whigs in 1848. Born, 1784; died, 1850.

Temple, Sir William. English statesman and author. Negotiated the Triple Alliance of 1668. Born, 1628; died, 1699.

Tennyson, Alfred. English poet. Educated at Cambridge; made poet-laureate in 1850. *In Memoriam*, *Enoch Arden*, *The Princess*, *Maud*, *The Idylls of the King*, *Queen Mary*, *Harold*. Born, 1809; died, 1893.

Tesla, Nikola. American electrician of Servian birth. He made remarkable experiments with currents of high frequency, and invented useful electrical devices. Born, 1857.

Thackeray, William Makepeace. English novelist; born in Calcutta. *Henry Esmond*, *Vanity Fair*, *The Newcomes*, *Pendennis*, *The Four Georges*, *English Humorists*. Born, 1811; died, 1863.

Thiers, Louis Adolphe. First President of the French Republic (1871–73.) *History of the Consulate and Empire*. Born, 1797; died, 1877.

Thomas, George H. American Federal general. Saved army at Chickamauga; won battle of Nashville. Born, 1816; died, 1870.

Thompson, Sir John S. O. Canadian jurist. Attorney-General and Minister of Justice (1885); Premier of Canada (1893). Born, 1844; died, 1894.

Thomson, James. Scotch poet. *The Seasons*, *The Castle of Indolence*, *Tancred and Sigismunda*. Born, 1700; died, 1748.

Thoreau, Henry D. American author. *The Concord and Merrimac Rivers*, *The Maine Woods*. Born, 1817; died, 1862.

Thorwaldsen, Albert D. Danish sculptor. *Triumphal March of Alexander*, Statues of *Christ and His Apostles*. Born, 1770; died, 1844.

Tindale, William. English reformer and martyr. Translated the New Testament into English. Was strangled and burned at the stake for heresy. Born, 1480; died, 1536.

Tilden, Samuel J. American Democratic statesman. Candidate for President in 1876. Born 1814; died, 1885.

Titian. (Tiziano Vecelli.) Italian painter. Among his masterpieces are the *Assumption of the Virgin*, *Presentation of the Virgin*, *The Last Supper*. Born, 1477; died, 1566.

Tocqueville, Alexis C. H. C. de. French author. *American Democracy.* Born, 1805; died, 1859.

Tolstoi, Count Leo. Russian writer and social reformer. Famous as a poet and novelist; devoted himself to remedy the ills of poverty; living and toiling like a peasant. In 1901 he was banished from Russia on account of his radical teachings. *War and Peace*, *Anna Karenina*, *The Kreutzer Sonata*, etc. Born, 1828.

Toombs, Robert. American statesman. United States Senate, 1853-59; leader of Georgia secessionists. Born, 1810; died, 1885.

Torricelli, Evangelista. Italian physicist. Inventor of the barometer. Born, 1608; died, 1647.

Toussaint l'Ouverture, Francois. Negro chief of the Haytien Rebellion. Born, 1743; died, 1803.

Trollope, Anthony. English novelist. *Barchester Towers.* Born, 1815; died, 1882.

Trowbridge, John Townsend. American author, poet, and juvenile writer. *Coupon Bonds* and *The Vagabonds* are his best known productions. Born, 1827.

Tupper, Sir Charles. A Canadian statesman. Served in several ministerial offices, and as Lord High Commissioner in London; Premier (1896). Born, 1821.

Turner, Joseph M. W. English painter. *The Slave Ship.* Born, 1775; died, 1851.

Tweed, William Marcy. Famous Tammany "boss" in New York City. Convicted of fraud and imprisoned; escaped to Spain, but was sent back, and died in prison. Born, 1823; died, 1878.

Tyler, John. American President. Born in Virginia; practiced law; M. C. 1816-21; Governor of Virginia 1825; elected U. S. Senator 1827; resigned 1836; elected Vice-President on Whig ticket 1840; succeeded Harrison on his death in 1841. Born, 1790; died, 1862.

Tyndall, John. English physicist. *Heat Considered as a Mode of Motion.* Born, 1820; died, 1893.
Attorney-General of New York 1815; leading man of the "Albany Regency;"

Van Buren, Martin. American President. Entered bar 1803; elected U. S. Senator by the Democrats 1821; Governor of New York 1828; Secretary of State 1829-31; Vice-President 1833-37; President 1837-41. Born, 1782; died, 1862.

Vandyke, Sir Anthony. Flemish painter in England. Pupil of Rubens; settled in England in 1632, among his best works are *The Erection of the Cross*, *Portrait of the Earl of Strafford*, and a *Crucifixion.* Born, 1599; died, 1641.

Van Rensselaer, Stephen. American statesman and landholder. *The Patroon.* Founder of the Rensselaer Institute. Born, 1764; died, 1839.

Vancouver, George. English navigator. Discoverer of Vancouver's Island. Born. 1758; died, died 1798.

Vanderbilt, Cornelius. American capitalist. Founder of the Vanderbilt family and fortune. Born, 1794; died, 1877.

Vane, Sir Henry English painter. Statesman; leader of independents; head of navy; beheaded. Born, 1612; died, 1662.

Verdi, Guiseppe. Italian musical composer and Senator. Among his productions are *Ernani*, *La Traviata*, *Il Trovatore*, *Montezuma*, and *Aida.* Born, 1814; died, 1901.

Vespucius, Americus. Italian navigator. America was named after him. Born, 1451; died, 1512.

Victor, Emmanuel II. King of Sardinia; first King of Italy; restorer of Italian unity. Born, 1820; died, 1878.

Victor, Emmanuel III. King of Italy. Succeeded to the throne in 1900, on the assassination of his father, Humbert I. Born, 1869.

Voltaire, Francois M. Arouet de. French philosopher, poet, historian, wit, skeptic. Passed the years 1750-53 with Frederick the Great; took up his residence (1755) at Ferney; *The Age of Louis XIV.*, *Essay on the Manners of Nations*, and *Candide.* Born, 1694; died, 1778.

Wade, Benjamin F. American politician. Republican Senator from Ohio; Abolitionist. Born, 1800; died, 1878.

Wagner, Richard. German composer. *Lohengrin*, *Gotterdammerung*, *Tannhauser*, *Rheingold*, *Nibelungenlied;* produced *Parsifal* at Bayreuth, 1882. Born, 1813; died, 1883.

Wainwright, Richard. U. S. naval officer. Executive officer of the battleship *Maine*, blown up in Havana harbor; commander of the *Gloucester*, battle of Santiago, 1898. Born, 1849.

Wales, Albert Edward. Eldest son of Queen Victoria. Became King of England on the death of his mother, January, 1901, under the title of Edward VII. Born, 1841.

Wallace, Lewis. An American soldier and novelist. General in the Civil War; wrote *Ben Hur*, *The Prince of India*, etc. Born, 1827.

Wallace, Sir William. Scotch patriot and general. Fought Edward I. of England; executed. Born, 1270; died, 1305.

Wallenstein, Albert, Count of, German general. Opponent of Gustavus Adolphus, by whom he was defeated, 1632; in 1634 he was deprived of his command and assassinated. Born, 1583; died, 1634.

Walton, Izaak. English writer. *The Complete Angler.* Born, 1593; died, 1683.

Wanamaker, John. An American merchant. Originator of the department store idea; Postmaster-General 1889-93. Born, 1838.

Ward, Mrs. Humphrey. English novelist. Granddaughter of Dr. Arnold, of Rugby. *Robert Elsmere*, *Marcella*, etc. Born, 1851.

Warner, Charles Dudley. American humorist and essayist. *Summer in a Garden*, *Back-log Studies*, *Washington Irving* (1881), *Captain John Smith*, *In the Levant.* Born, 1828; died, 1900.

Washington, George. Commander-in-chief in the American Revolution. First President of the United States; aide-de-camp to Braddock in the Indian campaign of 1755; married Martha Custis, 1759; chosen to Congress, 1774; appointed Commander-in-chief, 1775; President, 1789-97. Born, 1732; died, 1799.

Watt, James. Scotch inventor. Principal inventor of the steam engine; used the expansive force of steam to depress a piston; improved engines for pumping water. Born, 1736; died, 1819.

Webster, Daniel. American lawyer, orator, and statesman. Greatest legal effort was the Dartmouth College case; greatest Congressional speech was his reply to Hayne. Born, 1782; died, 1852.

Webster, Noah. American lexicographer. *Dictionary of the English Language.* Born, 1758; died, 1843.

Wedgewood, Josiah. English potter. Originator and maker of the famous "Wedgewood" ware. Born, 1730; died, 1795.

Wellington, Arthur Wellesley. Duke of. British general and statesman. General in India; was made commander-in-chief in Spain and Portugal; fought the battles of Talavera, Sabagal, and Albuera; captured Badajos, 1812; won at Waterloo, 1815; was afterward Prime Minister and Minister of Foreign Affairs. Born, 1769; died, 1852.

Wesley, Charles, Rev. English poet and divine. *Hymns.* Born, 1708; died, 1788.

Wesley, John. Founder of the Methodist Wesleyans. Born, 1703; died, 1791.

West, Benjamin. American painter in England. *The Death of Wolfe, Death on the Pale Horse.* Born, 1738; died, 1820.

Westinghouse, George. American inventor. Famous for inventing the Westinghouse air-brake. Born, 1846.

Wheeler, Joseph. American soldier. Graduated at West Point in 1859; entered Confederate service in Civil War; entered Congress, 1881; took part in the Santiago campaign in Cuba in 1898; served in the Philippines in 1899; appointed brigadier general in U. S. army. Born, 1836.

Whitefield, George, Rev. English Methodist preacher and revivalist. Born, 1714; died, 1770.

Whitney, Eli. American inventor. The cotton-gin. Born, 1765; died, 1825.

Whittier, John Greenleaf. American poet, farmer, shoemaker, journalist, anti-slavery agitator. *Snow-Bound, Voices of Freedom, Home Ballads, In War Time, The Tent on the Beach.* Born, 1808; died, 1893.

Whitman, Walt. American poet. Editor, carpenter, nurse, government clerk. *Leaves of Grass, The Two Rivulets, Drum Taps, Democratic Vistas.* Born, 1819; died, 1892.

Wilberforce, William. English philanthropist, statesman, and reformer. Secured abolition of slave trade. Born, 1759; died, 1833.

Willard, Frances Elizabeth. American temperance reformer and lecturer. Founder of the World's W. T. C. U., and its first president; author of several reformatory works. Born, 1839; died, 1898.

William I. Seventh King of Prussia, and first German Emperor. He succeeded to the throne in 1861, and was crowned Emporer in 1871, on the formation of the German Empire after the Franco-Prussian War. Born, 1797; died, 1888.

William II. Emperor of Germany. Son of Frederick, the second Emperor, whom he succeeded in 1888. Born, 1859.

Williams, Roger. Founder of Rhode Island Colony. Born, 1606; died, 1683.

Winthrop, John. Governor and founder of the Massachusetts Bay Colony. Born, 1588; died, 1649.

Wolsey, Thomas, Cardinal. English statesman. Chancellor of Henry VIII.; secured Henry's divorce from Catherine. Born, 1471; died, 1530.

Worcester, J. E. American lexicographer. *Dictionary.* Born, 1734; died, 1866.

Wordsworth, William. English poet. Educated at Cambridge; with Coleridge produced *Lyrical Ballads,* 1798; settled at Rydal Mount, 1803; published *Poems,* 1807; *The Excursion,* 1814. Among his other works are *Ecclesiastical Sonnets, The Wagoner, Yarrow Revisited, The Prelude.* Born, 1770; died, 1850.

Wren, Sir Christopher. English architect. St. Paul's Cathedral. Born, 1632; died, 1723.

Wycliffe, John. English reformer. Translator of the Scriptures. Born, 1324; died, 1384.

Xavier, Francis, Saint. "Apostle of the Indies." Jesuit missionary to India and Japan. Born, 1506; died, 1552.

Xerxes I. King of Persia. Invader of Greece; beaten at Salamis. Born, B. C. —; died, 465.

Yale, Elihu. Founder of Yale College. Born, 1648; died, 1721.

Yonge, Charlotte. A well-known author, writer of novels, and children's books and histories. *The Heir of Redclyffe, Cameos of History of England.* Born, 1823; died, 1901.

Young, Brigham. American religionist. Head of the Mormons. Born, 1801; died, 1877.

Young, Edward. English poet. Rector of Welwyn, in Hertfordshire. *Night Thoughts, The Revenge, The Love of Fame.* Born, 1684; died, 1756.

Zenobia, Septimia. Queen of Palmyra (266–73.) Her dominions extended from the Mediterranean to the Euphrates, and included a large part of Asia Minor. She refused allegiance to Aurelian, who defeated her and captured Palmyra; passed the rest of her life at Tibur, in Italy. Born, —; died, 275.

Zeuxis. Greek painter. *The Infant Hercules Strangling a Serpent.* Flourished B. C. 5th century.

Zinzendorf, Nicholas Louis, Count of. Founder of the Moravians. *The Journey of Atticus Through the World.* Born, 1700; died, 1760.

Ziska, John. Hussite chief. Beat Imperial armies thirteen times. Born, 1360; died, 1424.

Zola, Emile. French novelist. Wrote *Contes a Ninon* and other collections of short stories, and a large number of realistic novels. Among the latest are *Lourdes, Rome,* and *Paris* Born, 1840.

Zoroaster. A Persian philosopher. Distinguished as the founder of the Magian religion. 1500 to 200 B. C.

Zwingli, Ulric. Swiss reformer. *Exposition of the Christian Faith.* Killed in battle. Born 1484; died, 1531.

Zwirner, Ernst Friedrich. German architect. Completed Cathedral of Cologne; built many castles on the Rhine, famed for their beauty. Born, 1802; died, 1861.

BOOK III.

EVERY-DAY BUSINESS GUIDE

PRACTICAL HELPS IN GRAMMAR—SPELLING AND COMPOSITION—LESSONS
IN PENMANSHIP WITH MODEL COPIES—FORMS FOR ALL KINDS
OF BUSINESS PAPER—MONEY AND BANKING—BOOKKEEPING PRACTICALLY
ILLUSTRATED—HOW TO USE FIGURES QUICKLY
A VOCABULARY OF COMMON BUSINESS TERMS.

A PRACTICAL BUSINESS INSTRUCTOR AND GUIDE

PREPARED AND EDITED BY
PROFESSOR E. C. MILLS, of Rochester, N. Y.,
PROFESSOR R. S. COLLINS, of Philadelphia, Pa.,
AND OTHER SPECIALISTS.

Every Day Address

Many men and women are by training very proficient in their trades or professions, but do not make much headway because they cannot give proper expression to their thoughts. Around them are found other men and women who may not be as expert in their trades or profession, but who have the faculty of giving clear expression to what they do know, and can therefore impress their knowledge upon their hearers in a way that can be understood. In THE LANGUAGE WE SPEAK is given the best forms of expression, with examples, so that the study of this book will enable a person to give clear expression to the knowledge of things he or she may possess.

THE LANGUAGE WE SPEAK

ITS INTERESTING HISTORY—ITS FORMATION—ITS MILESTONES
—ITS DIVISIONS BY POINTS—ITS GRAMMAR—ITS
SPELLING—ITS CORRECT USE—ITS
FLOWERS OF SPEECH

OUR MOTHER TONGUE

Language has a history just as the living being who uses it. It has gone through periods of change and development which correspond to the many changes in the history of the race from the few words or sounds of man who lived in the cave to the complete vocabulary of the most learned American. It is of first importance to every one aspiring to success in the correct use of our language to appreciate fully what a wonderful instrument it is. This requires that a brief account be given of its history and composition.

We speak of the "English tongue" or of the "French language"; and we say of two nations that they "do not understand each other's speech." The existence of these three words—*speech*, *tongue*, *language*—proves to us that a language is something *spoken*,—that it is a number of *sounds;* and that the writing or printing of it upon paper is a quite secondary matter. Language, rightly considered, then, is an *organized set of sounds*. These sounds convey a meaning from the mind of the speaker to the mind of the hearer, and thus serve to connect man with man.

It took many hundreds of years—perhaps thousands—before human beings were able to invent a mode of writing upon paper—that is, of representing *sounds* by *signs*. These signs are called *letters;* and the whole set of them goes by the name of the *Alphabet*—from the two first letters of the Greek alphabet, which are called *alpha*, *beta*. There are languages that have never been put upon paper at all, such as many of the African languages, many in the South Sea Islands, and other parts of the globe. But in all cases, every language that we know anything about—English, Latin, French, German—existed for a long time before any one thought of writing it down on paper.

Curious Changes in Language.

Our language has grown; it is growing still; and it has been growing for many hundreds of years. As it grows it loses something, and it gains something else; it alters its appearance; changes take place in this part of it and in that part,—until at length its appearance in age is something almost entirely different from what it was in its early youth. If we had the photograph of a man of forty, and a photograph of the same person when he was a child of one, we should find, on comparing them, that it was almost impossible to point to the smallest trace of likeness in the features of the two photographs. And yet the two pictures represent the same person. And so it is with the English language. The oldest English, which is usually called Anglo-Saxon, is as different from our modern English as if they were two distinct languages; and yet they are not two languages, but really and fundamentally one and the same. Modern English differs from the oldest English as a giant oak does from a small oak sapling, or a broad stalwart man of forty does from a feeble infant of a few months old.

The English language is spoken by the Anglo Saxon race in all parts of the world, including England, most parts of Scotland, the larger part of Ireland, the United States, Canada, Australia, New Zealand, and South Africa. In the middle of the *fifth* century it was spoken by a few thousand men who had lately landed in England from the Continent; it is now spoken by nearly *two hundred millions of people*. In the course of the next one hundred years, it will probably be the speech of three hundred millions.

The Family of our English Language.

Our English tongue belongs to the *Aryan* or *Indo-European Family* of languages. That is to say, the main part or substance of it can be traced back to the race which inhabited the high table-lands that lie to the back of the western end of the great range of the Himalaya, or "Abode of Snow." This Aryan race grew and increased, and spread to the south and west; and from it have sprung languages which are now spoken in India, in Persia, in Greece and Italy, in France and Germany, in Scandinavia, and in Russia. From this Aryan family we are sprung; out of the oldest Aryan speech our own language has grown.

Our own language has been in the process of formation for centuries, and that it still is changing and adding new words indicates it has vitality and is a living language. A language is said to be *dead* when it is no longer spoken. Such a language we know only in books. Thus, *Latin* is a dead language, because no nation anywhere now speaks it. A dead language can undergo no change; it remains, and must remain, as we find it written in books. But a living language is always changing, just like a tree or the human body: The human body has its periods or stages. There is the period of infancy, the period of boyhood, the period of manhood, and the period of old age. In the same way, a language has its periods.

We divide the English language into periods, and then mark, with some approach to accuracy, certain distinct changes in the habits of our language, in the inflexions of its words, in the kind of words it preferred, or in the way it liked to put its words together. But we must be carefully on our guard against fancying that, at any given time or in any given year, the English people threw aside one set of habits as regards language, and adopted another set. It is not so, nor can it be so. The changes in language are as gentle, gradual, and imperceptible as the changes in the growth of a tree or in the skin of the human body. We renew our skin slowly and gradually; but we are never conscious of the process, nor can we say at any given time that we have got a completely new skin.

—Bearing this caution in mind, we can go on to look at the chief periods in our English language. These are five in number; and they are as follows:—

I. Ancient English or Anglo-Saxon,	449–1100
II. Early English, ...	1100–1250
III. Middle English, ...	1250–1485
IV. Tudor English, ...	1485–1603
V. Modern English, ...	1603–1900

These periods merge very slowly, or are shaded off, so to speak, into each other in the most gradual way. If we take the English of 1250 and compare it with that of 900, we shall find a great difference; but if we compare it with the English of 1100 the difference is not so marked. The difference between the English of the twentieth and the English of the fourteenth century is very great, but the difference between the English of the fourteenth and that of the thirteenth century is very small.

The Grammar of the Language

Was fixed before the seventeenth century, most of the case-endings having entirely vanvanished. The vocabulary of the language, however, has gone on increasing, and is still increasing; for the English language, like the English-speaking peoples, is always ready to offer hospitality to all peaceful foreigners —words or human beings— that will land and settle within their coasts. And the tendency at the present time is not only to give a hearty welcome to newcomers from other lands, but to call back old words and old phrases that had been allowed to drop out of existence. Tennyson, Lowell and other of our modern writers have been among the chief agents in this happy restoration.

The Vocabulary Increased.

When the Angles or English went over to the British Isles in the fifth century, the number of words in the language they spoke was probably not over *two thousand*. Now, however, we possess a vocabulary of perhaps more than *one hundred thousand words*. And so eager and willing have we been to welcome foreign words, that it may be said with truth that: *The majority of words in the English Tongue are not English*. In fact, if we take the Latin language by itself, there are in our language more *Latin* words than *English*. But the grammar is distinctly English, and not Latin at all.

We must not forget what has been said about a language,—that it is not a printed thing—not a set of black marks upon paper, but that it is in truest truth a *tongue* or a *speech*. Hence we must be careful to distinguish between the *spoken* language and the *written* or *printed* language; between the language of the *ear* and the language of the *eye;* between the language of the *mouth* and the language of the *dictionary;* between the *moving* vocabulary of the market and the street, and the *fixed* vocabulary that has been catalogued and imprisoned in our dictionaries. If we can only keep this in view, we shall find that, though there are more Latin words in our vocabulary than English, the English words we possess are *used* in speaking a hundred times, or even a thousand times, oftener than the Latin words. It is the genuine English words that have life and movement; it is they that fly about in houses, in streets, and in markets; it is they that express with greatest force our truest and most usual sentiments—our inmost thoughts and our deepest feelings. Latin words are found often enough in books; but, when an English man or woman is deeply moved, he speaks pure English and nothing else. Words are the coin of human intercourse; and it is the native coin of pure English with the native stamp that is in daily circulation.

How Strange Words Come In.

The different peoples and the different circumstances with which our race has come in contact, have had many results—one among others, that of presenting us with contributions to our vocabulary. Kelts were found in England; and hence we have a number of Keltic words in our vocabulary. The Romans held the island for several hundred years; and when they had to go in the year 410, they left behind them a few Latin words, which we have inherited. In the seventh century, Augustine and his missionary monks from Rome took over a larger number of Latin words; and the Church which they founded introduced even more and more words from Rome. The Danes began to go over to England in the eighth century; there was for some time a Danish dynasty seated on the throne of England; and hence there are many Danish words. The Norman-French invasion in the eleventh century took over many hundreds of Latin words; for French is in reality a branch of the Latin tongue. The Revival of Learning in the sixteenth century gave us several thousands of Latin words. And wherever English-speaking sailors and merchants have gone, they have brought back with them foreign words as well as foreign things—Arabic words from Arabia and Africa, Hindustani words from India, Persian words from Persia, Chinese words from China, and even Malay words from the peninsula of Malacca.

SPANISH WORDS.—The words we have received from the Spanish language are not numerous, but they are important. The following are a few of them:—

Alligator, *Armada*, *Barricade*, *Battledore*, *Bravado*, *Buffalo*, *Cargo*, *Cigar*, *Cochineal*, *Cork*, *Creole*, *Desperado*, *Embargo*, *Filibuster*, *Flotilla*, *Grenade*, *Guerilla*, *Indigo*, *Merino*, *Mosquito*, *Mulatto*, *Negro*, *Octoroon*, *Quadroon*, *Renegade*, *Savannah*, *Tornado*, *Vanilla*.

ITALIAN WORDS.—Italian literature has been read and we owe to the Italian language a large number of words. The following are a few of the more common ones:—

Alarm, *Alert*, *Alto*, *Balcony*, *Bandit*, *Bankrupt*, *Bravo*, *Brigade*, *Brigand*, *Bust*, *Cameo*, *Canteen*, *Canto*, *Carnival*, *Cartoon*, *Cascade*, *Citadel*, *Concert*, *Cornice*, *Corridor*, *Cupola*, *Ditto*, *Domino*, *Folio*, *Fresco*, *Gazette*, *Granite*, *Guitar*, *Incognito*, *Influenza*, *Lava*, *Madonna*, *Malaria*, *Manifesto*, *Motto*, *Moustache*, *Niche*, *Opera*, *Pantaloon*, *Pianoforte*, *Piazza*, *Portico*, *Ruffian*, *Serenade*, *Sonnet*, *Soprano*, *Stanza*, *Studio*, *Tenor*, *Trombone*, *Umbrella*, *Vista*, *Volcano*.

DUTCH WORDS.—The Dutch are a great seafaring people and have given us a number of words relating to the management of ships. The following are a few words which we owe to the Netherlands :—

Ballast, *Boom*, *Boer*, *Hoy*, *Luff*, *Reef*, *Skates*, *Skipper*, *Sloop*, *Smack*, *Smuggle*, *Yacht*, *Yawl*.

It will be interesting to note a few words which come directly from the Latin :

Antecessor, *Benediction*, *Cadence*, *Captive*, *Conception*, *Coffin*, *Corpse*, *Debit*, *Dilate*, *Example*, *Fabric*, *Faction*, *Fact*, *Fidelity*, *Fragile*, *Gentile*, *History*, *Hospital*, *Legal*, *Master*, *Mint*, *Nutriment*, *Oration*, *Particle*, *Pauper*, *Penitence*, *Persecute*, *Quiet*, *Radius*, *Regal*, *Respect*, *Secure*, *Senior*, *Separate*, *State*, *Tract*, *Tradition*, *Zealous*.

Also that the following come to us from the Latin through the French :

Ancestor, *Benison*, *Chance*, *Caitiff*, *Conceit*, *Coffer*, *Corps*, *Debt*, *Delay*, *Sample*, *Forge*, *Fashion*, *Feat*, *Fealty*, *Frail*, *Gentle*, *Hotel*, *Loyal*, *Mr.*, *Money*, *Nourishment*, *Orison* (a prayer), *Parcel*, *Poor*, *Penance*, *Pursue*, *Story*.

Scientific Terms.

A very large number of discoveries in science have been made in this century ; and a large number of inventions have introduced these discoveries to the people, and made them useful in daily life. Thus we have *telegraph* and *telegram ; photograph ; telephone* and even *photophone* and *megaphone*. The word *dynamite* is also modern. Then passing fashions have given us such words as *athlete* and *æsthete*. In general, it may be said that, when we wish to give a name to a new thing—a new discovery, invention, or fashion—we have recourse not to our own stores of English, but to the vocabularies of the Latin and Greek languages.

The English Language for Ten Centuries.

We can mark out a few guide posts in the path of ten centuries traversed by our language each distinguished by a great event. A reference to any good History of England will give the reader particulars which will be fascinating and instructive. We give a few of the important events and dates which we should endeavor to remember.

1. *King Alfred* translated several Latin works into English, among others, Bede's 'Ecclesiastical History of the English Nation' . . . . . . (851) 901
2. *The Norman Conquest*, which introduced Norman-French words 1066
3. *Anglo-Saxon Chronicle*, said to have been begun by King Alfred, and brought to a close in 1160
4. *Sir John Mandeville*, first writer of the newer English Prose—in his 'Travels' which contained a large admixture of French words 1356
5. *Wyclife's Bible* 1380
6. *Geoffrey Chaucer*, the first great English Poet, author of the 'Canterbury Tales'; born in 1340, died 1400
7. *William Caxton*, the first English printer, brings out in Germany the first English book ever printed 1471
8. *First English Book* printed in England (by Caxton) the 'Game and Playe of the Chesse' 1474
9. *William Tyndale*, by his translation of the Bible "fixed our tongue once for all." His New Testament has become the standard of our tongue: the first ten verses of the Fourth Gospel are a good sample of his manly Teutonic pith" . . . 1526-30
10. *Edmund Spencer* publishes his 'Faerie Queene.' "Now began

the golden age of England's literature; and this age was to last for about fourscore years" 1590

11. *Our English Bible*, based chiefly on Tyndale's translation. "Those who revised the English Bible in 1611 were bidden to keep as near as they could to the old versions, such as Tyndale's" . 1611
12. *William Shakespeare* carried the use of the English language to the greatest height of which it was capable. He employed 15,000 words. (Born 1564) . 1616
13. *John Milton*, "the most learned of English poets," publishes his 'Paradise Lost,'—"a poem in which Latin words are introduced with great skill" . . . 1667
14. *John Bunyan* writes his 'Pilgrim's Progress'—a book full of pithy English idiom. "The common folk had the wit at once to see the worth of Bunyan's masterpiece, and the learned long afterwards followed in the wake of the common folk" (Born 1628) 1688
15. *Dr. Samuel Johnson* was the chief supporter of the use of the "long-tailed words in *osity* and *action*," such as his novel called 'Rasselas,' published, ... 1759
16. *Tennyson*, Poet-Laureate, a writer of the best English—"a countryman of Robert Manning's, and a careful student of old Malory, has done much for the revival of pure English among us" 1890

THE GRAMMAR OF THE ENGLISH LANGUAGE.

Whatever may be said of the English language in other respects, in simplicity it undoubtedly surpasses the rest of European tongues. It is free from intricacies of case, declension, mood, and tense. Its words are subject to but few terminational changes. Its substantives have no distinctions of gender except what nature has made. Its adjectives admit of such changes only as are necessary to denote the degrees of comparison. Its verbs, instead of running through all the varieties of ancient conjugation, suffer few changes. With the help of prepositions and auxiliaries, all possible relations are expressed, while the words for the most part retain their forms unchanged. We lose from this, no doubt, in brevity and strength; but we gain vastly in simplicity. The arrangement of our words is, in consequence, less difficult, and our sentences are more readily understood. The rules of our syntax are exceedingly simple, and the acquisition of our language is easy in proportion.

Parts of Speech.

Having traced briefly the history of our language, considered some of the sources from which it is derived, and noted its chief characteristics, we shall now proceed to treat of its words, viewed with reference to the respective parts they perform in a sentence. Some knowledge of grammar from text-books being presupposed, we shall here, by a brief summary, merely recall to mind its leading principles, with such definitions and illustrations only as are absolutely essential for practical purposes.

The classes into which words are divided with reference to their use and mutual relations, are called PARTS OF SPEECH. They are nine in number.

NOUNS are names of things. They are divided into two classes: COMMON NOUNS, or names that distinguish one class of objects from another—as *girl*, *lake*, *book*; and PROPER NOUNS, or names that distinguish one individual of a class from another, as *Rome*, *John*.

The term SUBSTANTIVE is frequently used as synonymous with *noun*. Besides nouns, it embraces whatever may be used as such; that is, pronouns, verbs in the infinitive, and clauses.

To nouns belong (a) Gender; masculine, feminine and neuter.

(b) Number: singular and plural.

(c) Case: nominative, possessive, objective and vocative.

PRONOUNS are words that may be used instead of nouns.

They are comprised in the following classes:—

1. PERSONAL, or such as show by their form what person they are; that is, whether they represent the person speaking, the person spoken to, or the object spoken of. The Personals are,

I, *thou*, *he*, *she*, *it*, and their compounds, *myself*, *thyself*, *himself*, *herself*, *itself*.

2. POSSESSIVE, such as denote possession. They are: *Substantive possessive: Mine*, *thine*, *his*, *hers*, *ours*, *yours*, and *theirs*, *Adjective possessive: my*, *thy*, *his*, *her*, *our*, *your*, *their*.
3. RELATIVES, or such as relate to a substantive going before, called an antecedent. The relatives are, *who*, *which*, and *that*. *What*, *whatever*, *whoever*, and *whichever*, include the antecedent, and are called compound relatives.
4. INTERROGATIVES, or such as are used to ask questions. The interrogatives are, *who*, *which* and *what*.
5. ADJECTIVE PRONOUNS, or such as on some occasions take the place of substantives, and on others are used with them, like adjectives. Under this head fall the words, *this*, *that*, *each*, *every*, *either*, *neither*, *no*, *none*, *any*, *all*, *such*, *some*, *both*, *other*, *another*.

ADJECTIVES are words which describe or limit substantives; as, The *ten great* authors.

The ARTICLES are included as adjectives and are placed before nouns to show whether they are used in a particular or general sense. We have two articles, *the*, called DEFINITE, and *an* or *a*, called INDEFINITE.

VERBS or words that express an action or state; as, "He *is* sure *to succeed*." That respecting which the action or state is primarily expressed is called the SUBJECT of the verb; thus, in the preceding example, *he* is the subject of the verb *is*.

Verbs are divided into two classes: TRANSITIVE, or such as express an act done to an object; and INTRANSITIVE, or such as express a state, or an act not done to an object. "James *reads* Latin," "James *can swim*," "James *is* asleep"; in the first sentence the verb is transitive; in the last two, intransitive.

To show the relation which the subject bears to the action expressed, transitive verbs have two distinct forms, called VOICES. The ACTIVE VOICE represents the subject of the verb as acting; as, "Cæsar *conquered* Pompey." The PASSIVE VOICE represents the subject of the verb as acted upon; as, "Pompey *was conquered* by Cæsar."

To verbs belong person, number, Mood, Tense, and Voice. In person and number the verb agrees with its subject.

Mood, or *Mode*, is the form of the verb which shows the manner of the action or condition expressed. The English verb has five moods: *indicative*, *potential*, *subjunctive*, *infinitive* and *imperative*.

The INDICATIVE mood expresses an absolute affirmation.

The POTENTIAL mood expresses possibility, inclination, ability, duty. Its signs are the auxiliary verbs, *may*, *can*, *must*, *might*, *could*, *would*, *should*.

The SUBJUNCTIVE expresses a condition. Its ordinary sign is *if*.

The INFINITIVE mood expresses action or condition without restriction of number or person. A verb in the infinitive mood has no subject, and consequently can make no affirmation.

The IMPERATIVE mood expresses a command.

Tense is the form of the verb which indicates the time of the action or condition.

The English verb has six tenses, the *present*, *perfect*, *present perfect*, *pluperfect*, *future*, and *future perfect*.

The PRESENT tense expresses a present action or condition; "It freezes."

The PERFECT tense expresses what took place, or was taking place in time past; "It froze." "It was freezing."

The PRESENT PERFECT tense expresses an action or condition indefinitely passed; "It has frozen."

The PLUPERFECT tense expresses what had occurred before some time past; "It had frozen before my departure."

The FUTURE tense expresses what will happen in future time; "It will freeze."

The FUTURE PERFECT tense expresses what will have happened after some future time specified or implied; "It will have frozen by four o'clock."

PARTICIPLES, are words which, partaking of the nature of adjectives and verbs, describe a substantive by assigning to it an action or a state. Transitive verbs have six participles, three in the active, and three in the passive, voice; as, *loving*, *loved*, *having loved*, and *being loved*, *loved*, *having been loved*. Intransitive verbs, admitting of no passive voice, have but three participles; as, *walking*, *walked*, *having walked*.

ADVERBS, are words added to verbs, participles, adjectives, and other adverbs, to express time, place, degree, comparison, manner, &c.; as, *now*, *here*, *very*, *so*, *gracefully*. Adverbs of manner for the most part end with the letters *ly*. This class of words must be carefully distinguished from adjectives, which also express manner or quality, but are always joined to substantives.

CONJUNCTIONS, used to connect words, sentences, and parts of sentences. The most common are,

and, as, although, because,
but, except, either, for,
if, lest, nor, neither,
or, since, that, than,
though, unless, whether, yet,

PREPOSITIONS, which show the relations between substantives and other words in a sentence. The following list contains the most common ones :

about,
above,
across,
after,
against,
along
among,
at,
before,
behind,
below,
beneath,
beside,
between,
by,
down,
during,
except,
for,
from,
in,
into,
out of,
of,
off,
on,
over,
save,
through,
to,
touching,
upon,
with,
within,
without.

INTERJECTIONS are used to denote a sudden emotion of the mind ; as, *ah*, *alas*, *O*, *oh*, *fie*, *hist*, &c.

Of these parts of speech, the noun, pronoun, and verb alone are inflected ; that is, undergo changes in termination to denote different cases, numbers, persons, &c.

That we may determine to which of the above classes a word belongs, we must examine the relations it sustains to the rest of the sentence ; and, as in different connections the same word often performs very different offices, it follows that in one sentence it may be one part of speech, and in another, another, according to its application. Reference to the dictionary and the meaning of the word will help decide the class to which a word belongs.

About Sentences.

All written or spoken language arranges itself into sentences which are described as assemblages of words which make complete sense ; as, "God is love."

Every sentence consists of two parts, subject and predicate.

The SUBJECT is that respecting which something is affirmed. In the above example, *God* is the subject.

The Predicate is that which is affirmed respecting the subject. In the above example, the words *is love* constitute the predicate.

As regards their signification, sentences are divided into four classes ; viz., Declarative, Interrogative, Imperative, and Exclamatory.

A Declarative Sentence is one that declares something. *The sun shines.*

Declarative sentences constitute the greater part of written language.

An Interrogative sentence is one that asks a question, and is generally introduced by an interrogative pronoun, *who*, *which*, or *what;* or, by an auxiliary, *do*, *am*, *have*, *shall*, *may*, &c.

An Imperative sentence is one that expresses a command, an exhortation, an entreaty, or permission, and is generally introduced by a verb in the imperative mood, *let* being often used for that purpose; as, "Go in peace ; " "Let him arise." The subject of an imperative sentence is often understood.

An Exclamatory Sentence is one that exclaims something ; as "How it snows ! "

As regards their construction, sentences are divided into three classes, Simple, Compound and Complex. Simple sentence are such as make complete sense when used alone.

Compound Sentences are such as have two or more simple sentences.

Complex Sentences are such as have a principal or independent sentence modified by one or more subordinate clauses or sentences.

Mistakes in Grammar

When words are used in improper forms, as "seen" for "saw," and "done" for "did," or when the use of one word is confused with that of another, we say that the user is ungrammatical and ignorant. A moderate knowledge of the grammar will enable every one to speak and write ordinary sentences correctly. But this should be supplemented by careful observation of the usage of the best writers and speakers. One should correct his own mistakes when discovered, and exercise care in not repeating these mistakes. Note the following errors which are to be avoided and test your own language and productions to see that they are clear of these errors.

1. Do not use the objective in place of the nominative ; as, "Him and me did it." Say "He and I."

2. Do not use the nominative for the objective of the pronoun ; as, "*who* are you looking for ? " instead of *whom*. This is an error that can always be avoided by putting the preposition at the beginning of the sentence, not at the end : as, "For *whom* are you looking ? "

3. Do not use *like* instead of *as ;* "She looked like [as] she did a year ago."

4. Do not use *them* for *these*, or *this here* for *this;* as "Give me them books."

5. Do not use *done* for *did*, *seen* for *saw*, *has went* for *has gone*, and similar improper forms of verbs.

6. Do not confuse use of each other and one another. The former should only be used in reference to two persons: "Let us all then promise each other [one another.]"

7. Do not confuse a transitive verb with an intransitive. Say "I lie, lay or have lain on the sofa" and "I lay, laid or have laid the book on the table." So also in the use of *sit* and *set*, *raise* and *rise*, *lean* and *teach*, and other verbs.

8. Do not use singular form of a verb with plural subject or more than one subject; as "The man and woman is at the door;" "The theatres is crowded."

9. Do not use a plural verb with a singular subject. This mistake often happens when a plural noun or two connected singular nouns are connected with the subject; as, "The Story of all his adventures and wanderings make [makes] an interesting book."

10. Do not use two negatives instead of one; as, "I didn't see no one."

11. Do not say don't for doesn't in the third person singular of the present indicative; as "It don't [doesn't] matter." "He don't [doesn't] know." This is a mistake of frequent occurrence even among cultured people.

12. Do not use adjectives for adverbs in "ly"; say, "The birds fly swiftly" not "swift," and "He writes well" not "good." On the other hand do not use adverbs in "ly" for adjectives; say "She looks beautiful," not "beautifully."

13. Avoid the use of slang; as, "You bet," "level best," "go it blind" and similar expressions.

14. Do not use Superlative of the adjectives when Comparative is required; say "He is the stronger of the two," not "strongest."

How to Use Capital Letters

It is of the greatest importance that the Capital Letters be used correctly and in accordance with some fixed rules, or otherwise the manuscript will have a very untidy appearance, and confusion in meaning may arise in the mind of the reader. The correct use of Capitals in letters is an art easily cultivated and will often be the means of securing favorable consideration for the one who pens the letter.

We here give the most important rules which, if followed, will secure correct use of Capital Letters.

The Small Letters of our Alphabet constitute the great bulk of all kinds of printed or written matter. Capitals, however, are employed in certain cases at the commencement of words, for the purpose of attracting special attention.

Begin with a Capital, (1) The first word of every sentence; (2) All proper nouns, and titles of office, honor, and respect; as, *Rome*, *Avenue*, *Mr. Chairman*, *Dr. Franklin*, *Gen. Washington.*

Under this head fall adjectives, as well as common nouns, when joined to proper nouns for the purpose of expressing a title; as, Alexander the *Great*, *King* William, *Good Queen* Bess.

(3) All adjectives formed from proper nouns; as, *Roman*, *Spanish*, *Elizabethan.*

(4) Adjectives denoting a sect or religion, whether formed from proper nouns or not; as, *Catholic*, *Protestant*, *Universalist.*

(5) Common nouns when spoken to, or spoken of, in a direct and lively manner, as persons, that is personified.

(6) The first word of every line of poetry; as,

"Should certain persons die before they sing."

(7) All appellations of the Deity, and the personal pronouns *he* and *thou* when standing for His name.

(8) The first word of a direct quotation; that is, one that forms a complete sentence by itself and is not connected with what precedes by *that*, *if*, or any other conjunction, as, "Remember the old maxim: 'Honesty is the best policy.'"

(9) The pronoun *I*, and the interjection *O*, must always be written with Capitals.

(10) Begin with a Capital every noun, adjective, and verb, in the titles of books and headings of chapters; as, "Hervey's '*Meditations* among the *Tombs.*'" "Ernest Seton Thompson's 'Wild Animals I Have Known.'"

Observe the difference between the interjections *O* and *oh*. The former is used only before the names of objects addressed or invoked, is not immediately followed by an exclamation-point (!) and must always be a capital; the latter is used by itself to denote different emotions of the mind, has an exclamation-point after it, and begins with a Small Letter, except at the commencement of a sentence.

Use a Small Letter in all cases where one of these rules does not apply. When in doubt, use a Small Letter.

Use of Punctuation Marks

Punctuation may be called the art of dividing written language by points, in order that the relations of words and clauses may be plainly seen, and their meaning be readily understood.

In spoken language, these relations are sufficiently indicated by the pauses and inflections of the voice; but as written language has no such aids, it is necessary to supply the deficiency with arbitrary marks.

The ancients originally wrote their manuscripts without marks or divisions of any kind. Points are said to have been first used about 200 B. C., by Aristophanes, a grammarian of Alexandria, but did not come into general use for several centuries. The modern system of punctuation was invented by Manutius, a learned printer who flourished in Venice at the commencement of the sixteenth century. To him we are indebted for developing the leading principles of the art, though in some of their details they have since that time undergone considerable modification. As there is no man at whose hands business or friendship does not require an occasional letter, so there is none that need be unable, by a proper use of points, to make his meaning intelligible.

Good usage differs widely in regard to punctuation; it is therefore impossible to lay down any fixed rules on the subject. Let the following general principles with regard to punctuation be constantly borne in mind.

The principal use of points is to separate words and clauses, and indicate the degree of connection between them. Thus, clauses between which the connection is close must be separated by commas; those in which it is more remote by semicolons.

(2) They perform another office by showing to what class a sentence belongs. Thus, "George is well," followed by a period is a declarative sentence, asserting that George is in good health; followed by an interrogation-point, it is an interrogative sentence, and implies belief that he is well together with an inquiry whether it is not so; in other words, it is equivalent to "George is well; is he not?" This important difference of meaning can be conveyed in no other way than by the use respectively of the period and interrogation-point.

(3) Points are also employed to indicate a sudden transition or break in the construction or meaning. Thus, where a sentence is suddenly interrupted or broken off, a dash is placed; as, "Woe to the destroyer! woe to the——."

(4) Finally they are used to denote the omission of words. Such is the office of the commas in the following sentence: "Reading maketh a full man; conference, a ready man; writing, an exact man." The verb *maketh* being left out in the last two clauses, commas are inserted to denote the omissions.

(5) Never introduce a point unless you have some positive rule for so doing. Whenever there is any reasonable doubt as to the propriety of employing a comma, do not use it. The tendency of punctuators at the present day is to introduce too many points.

The characters used in punctuation are as follows:

Period,	.	Semicolon	;
Interrogation-Point,	?	Comma,	,
Exclamation-Point,	!	Dash,	—
Colon,	:	Parentheses,	( )
		Brackets,	[ ]

WHEN TO USE THE PERIOD. — The period should be used, (1) After every declarative and imperative sentence; as, "Honesty is the best policy."—"Fear God."

(2) After every abbreviated word; as, *Dr. Geo. F. Johnson, F. R. S.*

(3) After Roman capitals and small letters when used for figures; as "Charles I was the son of James I."

THE COLON. — The colon is used to separate sentences which are only slightly connected and not completely separated as in the case of the period.

It is placed before a formal enumeration of particulars, and a direct quotation when referred to by the words *thus*, *following*, *as follows*, *this*, *these*.

THE SEMICOLON.—The semicolon is used to separate sentences which are closely related in memory. (1) When several long clauses occur in succession, all having common dependence on some other clause or word, they must be separated by semicolons; as, "If we neglected no opportunity of doing good; if we fed the hungry and ministered to the the sick; if we gave up our own luxuries, to secure necessary comforts for destitute; though no man might be aware of our generosity, yet in the applause of our own conscience we would have an ample reward."

A semicolon must be placed between the great divisions of sentences, when minor subdivisions occur that are separated by commas; as, "Mirth should be the embroidery of conversation, not the web; and wit the ornament of the mind, not the furniture."

When a colon is placed before an enumeration of particulars, the objects enumerated must be separated by semicolons.

THE COMMA.—The comma is used in various ways to separate the parts of the sentence, and to facilitate the reader's comprehension of the sense. The rules for the employment of the comma are many, and as employed in letters, business forms, and in ordinary composition, only the more important of the rules are observed. Examples of its use are so frequent on this and other pages that special ones need not be given here.

(1) A comma is placed between the particulars mentioned in a succession of words all in the same construction.

(2) A comma is placed before and one after every parenthetical expression.

(3) A comma is placed after each pair of words, when each pair is in the same construction.

(4) A comma is used before a quotation closely connected with the preceding words.

(5) A phrase or clause which explains, in any degree, the meaning of any other phrase or clause is separated from it by a comma.

(6) A comma is placed where a word is understood, unless the connection is close.

(7) A comma must be used in sentences which would otherwise be misunderstood.

(8) Expressions repeated must be separated by a comma.

(9) All modifying expressions, unless closely connected with the rest of the sentence, are separated by commas.

(10) Use the comma in all places where its use will tend to make the sense clearer, and where no other mark of punctuation is applicable.

EXCLAMATION AND INTERROGATION POINTS.—The use of Exclamation and Interrogation points is governed by a very few rules of easy application.

(1) An exclamation point is placed after every sentence, clause, phrase or word expressing sudden or violent emotion.

(2) Where special emphasis is required, several exclamation points may be used.

(3) An exclamation point, enclosed in parenthesis, is used to denote surprise.

(4) An interrogation point is placed after every sentence, phrase, clause, or word, which asks a direct question.

(5) An interrogation point enclosed in parenthesis is often used to denote doubt.

THE USE OF QUOTATION AND OTHER MARKS.—(1) Quotation marks are placed before and after words or passages quoted from another author, or represented in narratives as used in dialogue.

(2) Quotations consisting of more than one paragraph have the first quotation mark at the beginning of each paragraph, but the second is used only at the end of the last paragraph.

(3) When a quoted passage requires special attention, the first quotation mark may be used at the commencement of each line.

(4) When one quotation includes another, the latter has but half the first quotation mark before it, and half the second mark after it.

(5) THE PARENTHESIS encloses matter not actually connected with the sentence.

(6) BRACKETS are chiefly used to enclose corrections.

(7) THE HYPHEN is used to separate the syllables of a word.

(8) A sudden turn in a sentence and the omission of a word, or part of a word, are denoted by a Dash.

(9) A DASH is usually placed before the answer to a question, when they both belong to the same line.

(10) A DASH is often used instead of the parenthesis marks, and commonly used before an expression repeated for special emphasis.

(11) THE APOSTROPHE denotes a contraction by the omission of a letter, and also is used as the sign of possessive case.

(12) The CARET is used to show the omission of letters or words.

(13) The ASTERISK, DAGGER, and similar marks are used to refer to notes at the foot or side of the page.

The following are marks of reference, and are generally used to call attention to words, sentences, or notes placed at the bottom of the page:

1. The Asterisk,*.
2. The Dagger,†.
3. The Double Dagger, ‡.
4. And sometimes the Section, §.
5. The Parallel, ‖.
6. And the Paragraph, ¶.

Small letters or figures also are used to call attention to notes at the foot of the page.

The Section (§) is generally used for subdividing a chapter into lesser parts.

The Paragraph (¶) denotes the beginning of a new subject, and in manuscript it is often inserted upon a revisal of the matter to denote that a paragraph should commence in a certain place.

The Index (☞) is used where special attention is desired to be called to something of importance.

Helps in Spelling.

No rules fully meet the requirements for satisfactory helps in spelling, as all rules have exceptions. Frequent reference to the dictionary and careful observation of words which occur in daily reading will help to give one confidence. One should always associate the form of the written word with the meaning. The following will be found helpful, and should be carefully studied:

Words of one syllable ending in *l*, with a single vowel before it, have double *l* at the close; as, *pill*, *dell*.

Words of one syllable ending in *l*, with a double vowel before it, have one *l* only at the close; as, *hail*, *rail*.

Monosyllables ending in double *l* when compounded retain but one *l* each; as, *skilful*, *fulfil*.

Words of more than one syllable ending in *l* have but one *l* at the close; as, *delightful*, *faithful*. But if the accent fall on the last syllable, they have a double *l*; as, *befall*, *recall*, etc.

Derivations from words ending in *l* have one *l* only; as, *equality* from *equal*, *dulness* from *dull*; except they end in *er* or *ly*; as, *mill*, *miller*, *full*, *fully*.

Words ending in *e* drop the *e* before the termination *able*; as, *love*, *lovable*; except they end in *ce* or *ga*, when the *e* is retained; as in *change*, *changeable*.

The *i* and *e* often come together in a word, it will be found that in the majority of words *i* and *e* come together after an *l* or a *c*. After an *l*, *i* takes precedence—after a *c*, *e* takes precedence; as, be*lieve*, de*ceive*. When in doubt over an *i* and *e* following a *c* or *l*, remember the word *lice*, which serves as a guide, the *i* following the *l*, the *e* the *c*.

Participles in *ing* from verbs ending in *e*, drop the final *e*; as, *have*, *having*, *love*, *loving*; unless they come from verbs ending in double *e*, and then they retain both; as, *see*, *seeing*, *agree*, *agreeing*. The word *dye*, however, is an exception, and retains *e* before *ing*—*dyeing*.

Adverbs ending in *ly* and nouns in *ment* retain the final *e* of the primitives; as, *brave*, *bravely*; *confine*, *confinement*; except *acknowledgment* and *judgment*.

Monosyllables ending in a consonant, with a single vowel before it, double that consonant in derivatives; as, *sin*, *sinner*.

Monosyllables ending in a consonant, with a double vowel before it, do not double the consonant in derivatives; as, *troop*, *trooper*.

Words of more than one syllable ending in a single consonant, preceded by a single vowel and accented on the final syllable, double that consonant in derivatives; *compel*, *compelled*, *appal*, *appalling*.

Nouns ending in *y* preceded by a vowel form their plural by adding *s*, as *key*, *keys*; if *y* is preceded by a consonant, the plural is formed by changing *y* into *-ies*; as, *fly*, *flies*.

Compound words, whose primitives end in *y*, change *y* into *i;* as, *ugly*, *ugliness*.

How to Write Clearly.

Almost every one can learn to write clearly—that is, so that his meaning may be clear—so far, at least, as clearness depends upon the arrangement of words. Elegance, force and variety of style are far more difficult to acquire; but the observance of a few simple rules will assist much in expressing clearly our ideas. Every one who has occasion to express in writing his thoughts for the entertainment of himself or friends, or to write social or business letters, should at least endeavor to express clearly what he thinks. Of course, this will not take the place of ideas, but will make the ideas of the most practical service.

(1) Use words in their proper meaning.—Refer to the dictionary for doubtful cases.

Do not use *address* for *direct*, *balance* for *remainder*, *beat* for *excel*, *can* for *may*, *couple* for *two*, *dangerous* for *seriously sick*, *drive* for *ride*, *expect* for *suppose* or *believe*, *gent* for *gentleman*, *help* for *avoid*, *mad* for *angry*, *reputation* for *character*, *settle* for *pay*.

(2) Avoid exaggerations—as, *awfully*, *frightfully*, *stupendous* and similar words where "much" or "very" are meant.

(3) When using the Relative Pronoun, use "who" and "whom" in referring to persons; which," referring to animals, things and young children, and "that" for both animals and things.

(4) Observe that appropriate prepositions must follow certain words.

As this rule is constantly violated, a list of a few common adjectives and verbs is here presented, together with the prepositions properly used in connection with them.

Abhorrence *of*.
Accompanied *with* an inanimate object; *by* anything that has life.
Accuse *of*.
Acquaint *with*.
Adapted *to*.
Agree *with* a person; *to* a proposition from another; *upon* a thing among ourselves.
Analogy *between* (when two objects follow the preposition); *to*, *with* (when one of the substantives precedes the verb).
Arrive *at*, *in*.
Attended *with* an inanimate object; *by* anything that has life.
Averse *to*, *from*.
Capacity *for*.
Charge *on* a person; *with* a thing.
Compare *with* (in respect of quality); *to* (for the sake of illustration).
Congenial *to*.
Conversant *with* men; *with* or *in* things; *about* and *among* are sometimes used.
Copy *after* a person; *from* a thing.
Correspond *with*.
Die *of* a disease; *by* an instrument or violence.
Disappointed *of* what we fail to obtain; *in* what does not answer our expectations, when obtained.
Entrance *into*.
Expert *in*, *at*.
Followed *by*.
Militate *against*.
Profit *by*.
Reconcile (in friendship) *to*; (to make consistent) *with*.
Reduce (subdue) *under;* (in other cases) *to*.

Between is applicable to two objects only; *among*, to three or more. "A father divided a portion of his property *between* his two sons; the rest he distributed *among* the poor."

In must not be used for *into*, after verbs denoting entrance. "'Come *into* (not *in*) my parlor, said the spider to the fly.'"

In arranging the words of a sentence, observe

(1) Emphatic words must stand in emphatic positions; *i. e.*, for the most part, at the beginning or at the end of the sentence.

(2) Unemphatic words must, as a rule, be kept from the end.

(3) An interrogation sometimes gives emphasis.

(4) The Subject, if unusually emphatic, should often be transferred from the beginning of the sentence.

(5) The Object is sometimes placed before the Verb for emphasis.

(6) Where several words are emphatic, make it clear which is the most emphatic. Emphasis can sometimes be given by adding an epithet, or an intensifying word.

(7) Words should be as near as possible to the words with which they are grammatically connected.

(8) Adverbs should be placed next to the words they are intended to qualify.

(9) When "not only" precedes "but also," see that each is followed by the same part of speech.

(10) "At least," "always," and other adverbial adjuncts, sometimes produce ambiguity.

(11) Nouns should be placed near the nouns that they define.

(12) Pronouns should follow the nouns to which they refer, without the intervention of any other noun.

How to Write Forcibly.

This is a swift age. There is no time for reading long and tedious communications. To command attention, our ideas must be expressed forcibly, and at the first reading must carry conviction. No better example of this can be found than in the advertisements of our large department stores—or in the letters written by heads of great houses in course of their large correspondence—at the same time force should not be sought at the expense of ease and unity of style. We can define a forcible sentence as one which carries conviction—impression when read.

To secure force of expression :

(1) Choose strong, apt, and meaning words.

(2) Use striking figures or illustrations.

(3) Place the most important thing last and secure an impressive arrangement of words.

(4) Omit needless elements, and secure consequent conciseness of expression.

(5) Employ short, rather than long sentences, and select as modifiers single words and phrases, rather than clauses.

Say, "Henry was inclined to be lazy." Rather than "Henry's tendencies were in the direction of indolence."

Say, "Wishing me to become a scholar, my brother sent me to an academy." Rather than, "My brother felt that he would like me to become a scholar, and so he sent me to an academy."

Say, "A physician who was called, announced that the man had smallpox. This, of course, caused a panic in the household." And not,

"It having been decided to call a physician, when he arrived he said that the disease that the man had was smallpox, and this, of course, produced a great deal of excitement among the people in the house."

AN EASY STYLE is secured when the sentences are agreeable to the ear and are easily spoken. Cultivate the habit of framing sentences mentally before writing them ; harsh sounding and awkward words and phrases will then be avoided and harmonious expressions will be used in their places.

Avoid the use of high sounding words and phrases and disagreeable repetition of words or sounds. Avoid also the crowding of too many thoughts into one sentence.

The Use of Figures of Speech.

The English is a figurative language, that is, it is a language in which an idea is expressed by the use of words which may suggest something else than the literal meaning. Unconsciously we use these figures and often are unable to define them if asked to do so.

They are the special tools of our language, and as such, should be handled with care. If used skilfully they add strength and beauty, but if awkwardly used they make the user appear affected and makes him a subject of ridicule.

The more common figures of speech are the following :

SIMILE is the comparison of one object to another, and is generally denoted by *like*, *as*, or *so ;* as, "He shall be like a *tree* planted by the rivers of water."—"Thy smile is *as* the dawn of the vernal day."

METAPHOR indicates the resemblance of two objects by applying the name, attribute, or act of one directly to the other ; as, "He shall be a tree planted by the rivers of water." Metaphor is the commonest of all the figures.

ALLEGORY is the narration of fictitious events, whereby it is sought to convey or illustrate important truths. Thus in Psalm lxxx., the Jewish nation is represented under the symbol of a vine. Bunyan's "Pilgrim's Progress" is an allegory.

METONYMY is the exchange of names between things related. It is founded, not on resemblance, but on the relation of one expression used, to the idea ; as "Hear O *Israel*", i. e., *descendants of Israel*—"Our *ships* next opened a fire," i. e., our *sailors*. —"His *steel* gleamed on high", i. e., his *sword*.

Synecdoche is using the name of a part for that of the whole, the name of the whole for that of a part, or a definite number for an indefinite: as, "The sea is covered with *sails*", i. e., *ships*; "Our *hero* was gray, but not from age", i. e., his *hair* was gray; "*Ten thousand* were on his right hand", i. e., *a great number*.

Hyperbole is the exaggeration of attributes, or the assigning to a subject of a wonderful and impossible act as the result of ardent emotion; as, "They [Saul and Jonathan] were *swifter than eagles*, they were *stronger than lions*."

Hyperbolical expressions are of frequent occurrence in common conversation; we often say, *as cold as ice*, *as hot as fire*, *as white as snow*, etc., in all of which phrases the quality is exaggerated beyond the bounds of truth. Their frequency is to be attributed to the imagination, which always takes great pleasure in magnifying the objects before it.

Imagery is the representation of past events, or imaginary objects and scenes, as actually present to the senses; as "Cæsar *leaves* Gaul, *crosses* the Rubicon, and *enters* Italy", i. e., Cæsar *left* Gaul, *crossed* the Rubicon, etc.

Apostrophe is a turning from the regular course of the subject, into an invocation or address; as, "Death is swallowed up in victory. O death, where is thy sting? O grave where is thy victory?"

Personification, or Prosopopæia, is the attributing of sex, life, or action to an inanimate object; or the ascribing of intelligence and personality to an inferior creature; as, "The Sea *saw it* and *fled*."—"The Worm *aware* of his intent, *harangued* him thus."

Interrogation is the asking of questions, not for the purpose of expressing doubt or obtaining information, but in order to assert strongly the reverse of what is asked; as, "Doth God pervert judgment? or doth the Almighty pervert justice?" This figure imparts animation to style. It is constantly employed in the book of Job.

Antithesis is placing of opposites in juxta-position, for the purpose of heightening their effect by contrast, as, "*A good man* obtaineth favor of the Lord; but *a man of wicked devices* will He condemn." This figure is used with great effect in the Book of Proverbs, x–xv. It is one of the most effective ornaments that can be employed in composition.

Climax is the arrangement of a succession of words, clauses, members, or sentences, in such a way that the weakest may stand first, and that each in turn, to the end of the sentence, may rise in importance, and make a deeper impression on the mind than that which preceded it; as, "Who shall separate us from the love of Christ? Shall *tribulation*, or *distress*, or *persecution*, or *famine*, or *nakedness*, or *peril*, or *sword?*"

Irony is a figure by which is expressed directly the opposite of what it is intended shall be understood; as when Elijah said to the priests of Baal, who were trying to induce their false god to manifest himself miraculously, "Cry aloud, for he is a god," &c. This figure is often considered under the head of ridicule.

Onomatopœia is the use of a word or phrase formed to imitate the sound of the thing signified; as when we say, *rat tat tat*, to denote a knocking at the door; *bow wow*, to express the barking of a dog; or, *buzz*, *buzz*, to indicate the noise made by bees.

RAPID BUSINESS WRITING

HOW TO HOLD AND USE THE PEN—THE BEST FORMS FOR ALPHABET—HOW TO ACQUIRE RAPIDITY—STYLES FOR BUSINESS AND SOCIAL USES—BEGINNING AND CLOSING LETTERS—NOTES, CHECKS AND OTHER BUSINESS FORMS

PRACTICAL LESSONS IN USING THE PEN

BY E. C. MILLS, ROCHESTER, NEW YORK,
PRACTICAL PENMAN.

The time has arrived when good penmanship is more of a necessity than an accomplishment. But a few years ago many believed good writers were born, not made. Wherever penmanship has been properly taught the results obtained have been very gratifying, and we feel justified in saying that any one who is not encumbered with some physical or mental deformity can learn to write rapidly and legibly. To say that every one can become an artistic penman would be making a broad statement, but it is no longer doubted that almost any one can learn to write a good business style of penmanship.

In order to accomplish this much time and hard work is necessary for those who have acquired incorrect habits and who have wrong ideas of the meaning of good business writing. It is the aim of the author of this series of lessons to present the subject in such a way that the home learner may acquire, during his spare time, a rapid and legible style of business writing in a comparatively short time.

Before Beginning Practice.

It is often desirable to compare your work at different times with your previous writing that an accurate estimate may be made of the improvement made. For this reason we would suggest that you write the following in your very best style and preserve for future reference:

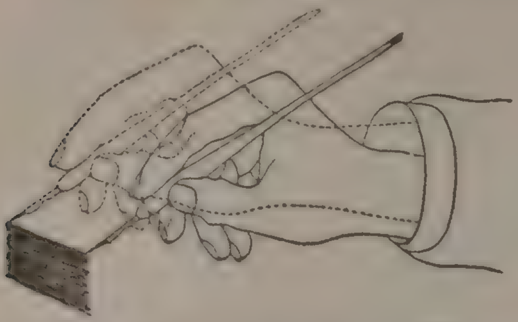
Your Place, State, Date.
This is a specimen of my very best penmanship before beginning practice in writing.
(Sign Your Name.)

What Materials to Use.

Your progress in penmanship will depend largely upon the materials used. Procure foolscap with a good finish and weight not less than twelve pounds to the ream. Do not try to economize by using poor materials. Ink should be used which flows freely and is black, or nearly so, when first used. Secure a pen that will make a line similar to that of the copies. We would suggest Gillott No. 604 or Esterbrook's A 1 Pen.

Pen-Holding.

The position of the hand and pen in learning to write is of great importance. Study the position of hand and pen in the cut. We do not expect all to assume this position, as no two people hold their pens exactly in the same way. The size and shape of the hand have much to do in regard to this point. It is a pretty safe rule to say that the holder should not be held sufficiently perpendicular to cross the second joint of the first finger, and should not fall much lower than that given in the illustration.



CUT I. POSITION OF THE HAND AND PEN.

The holder should cross the second finger at the root of the nail, or even just a little higher. The hand should be turned well toward the left, with the third and fourth fingers bent under the hand, resting on their nails. The wrist should not touch the paper.

Position of the Body.

The position of the body, as well as the hand and pen, is of utmost importance and requires the attention of every one who has a desire to improve his writing. A good position cannot be overestimated, and when once acquired is much more healthful and conducive to a free action of the muscles of the arm than an incorrect position. Then let all pay particular attention to the matter of position, especially at the beginning of this series of lessons. Eye yourself closely, as it is not an easy task to rid oneself of habits that have been forming for years, whether they are good or bad.

Take a position at the table nearly square in front, with both arms resting on table, the left with the elbow on the table from two to four inches, the right with the elbow projecting over the edge about two inches. The right arm should rest lightly upon the table and be free to move in any direction, while the body is supported on the left arm. The sides of the paper should be placed parallel to the right forearm. The paper should be held with the left hand *above* line of writing. Do not lean too far forward or bend over your work, as such a position is injurious to health, but if your eyes are not defective keep them from twelve to fourteen inches from the paper. Sit rather close to the table, but do not lean against it. Keep the feet flat on the floor and see that they do not become entangled with the legs of the table or the rounds of the chair. After reading the above instructions several times compare with the illustrations, then assume this position yourself and be ready for work.

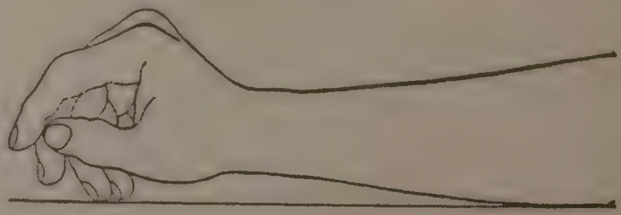
Movement.

Muscular movement is the foundation for all good, practical writing. Whatever may be said about slant or vertical writing, the system of penmanship that is not based upon free movement for its execution will be a failure if rapid business writing is desired. While a certain amount of form-teaching is commendable, still it is the arm-training that will be of service to the young man or woman in acquiring a rapid style of penmanship.

It is supposed that every one who takes up this series of lessons has a knowledge of the formation of all the capitals and small letters, although many write with a slow, laborious finger movement. It will be our aim to change the habit of writing these letters from the slow, labored style to one of ease and rapidity, with a few changes in the form of some letters. First allow the student to obtain a command of the pen, a control over the muscles of the arm, and he will naturally take enough interest in writing to improve in form also.

How to Begin.

You may now take the position of the hand and arm as shown in the illustration "2," without the use of the pen. By holding the hand in the correct position before taking the pen an easy movement of the arm may



CUT 2. POSITION OF HAND AND ARM.

be secured, as well as the foundation for proper penholding. Rest the hand on the nails of the two last fingers, and make the same motion that will produce the first exercise in Plate II.

Practice rapidly, making not less than 150 pulls toward the body per minute. Next practice sliding the hand from left to right and from right to left across part of the page as shown in Plate I. being sure to maintain the same position throughout. The arm-rest near the elbow should remain in the same place; the arm at the elbow should act as a sort of a hinge. Remember, all of this preliminary practice should be done without pen and ink. This kind of calisthenic practice should be taken until the arm will move readily in any direction. It is better if you take up one thing at a time, and learn to do that in the very best way possible; hence we desire to have you learn to move your arm before using the pen. Do not be in any hurry to take up more advanced work, as your progress will not be satisfactory unless the fundamental exercises have been thoroughly mastered.

How to Proceed.

Penholding will not seem very difficult if you have practiced in the manner suggested, and with the hand held in the same position as illustrated in Cut 2. Do not use ink at first, but practice with a dry pen. Make the oblique exercise as given in Plate II. This is one of the most essential motions used in writing, and a great deal of time should be spent in practicing it. The exercise is made by keeping the sleeve stationary on the table, and forcing the arm to move in and out of the sleeve, using no finger action whatever. Arm down. Study Cut 1, as the dotted lines show the vibration of the arm. Make this exercise fill two large spaces; we call the distance between the two blue lines one large space. Make the oblique exercise just twice that size. After the movement has become established, then you may use ink, but if you find the movement degenerating, commence at the beginning and repeat the same practice as before. Next run the exercise across the page, and try to make it black. This should not be done by pressing heavily on the pen, but by making a series of light lines before moving toward the right.

The Lateral Exercises.

The ability to write a long word without lifting the pen is an accomplishment that will promote rapid writing. To accomplish this the lateral exercises and wide spacing between the letters and words should receive a good share of your time for several months.

Practice on the first lateral exercise given in Plate I. Place the arm about in the center of the exercise, lengthwise, and make the exercise extend about half way across the entire page. Do not allow the hand to turn toward the right, but keep it in the same position as illustrated in Cut 1. Force the hand to slide on the last two finger nails. Make a slight pause at the end of each exercise, and use a steady, swinging motion of the arm. Keep the fleshy part of the forearm down on the table and in about the same place. The tendency at first will be to use the wrist movement; be careful to avoid this, and see that the larger muscles are used.

How to Practice.

Do not practice longer than one hour at a time. The first part of the hour should be devoted to the practice of movement exercises, even after you are capable of making them well. This will insure freedom of motion and smooth lines. This movement practice is excellent as long as the arm is used as the propelling power. If the fingers are used to any extent, the value of the practice is practically lost. If your movement at this time takes in a wide scope, although difficult to govern, your efforts have been directed in the right channel.

Do not be easily satisfied with your work. Criticise your position, your movement, and your writing at all times. Do not omit any of the work. Although some of the exercises may seem distasteful to you, it is just the kind of work that you need, and you should master them if you wish to make the most of your possibilities. Improvement is only promised to those who faithfully follow every detail of the instruction as it is given in each lesson.

Plate I

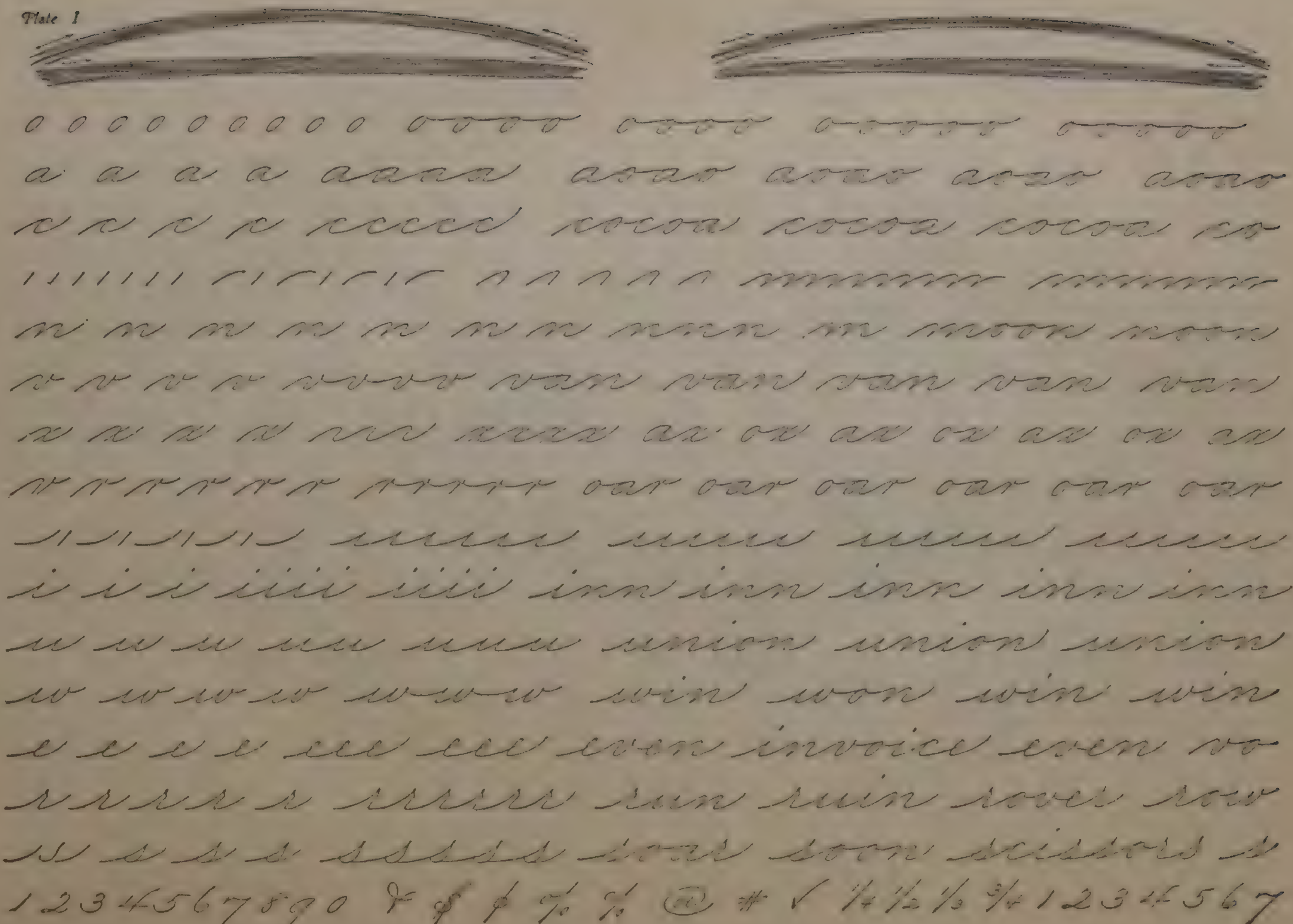

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
a a a a aaaa aoao aoao aoao aoao
c c c c ccccc cocoa cocoa cocoa co
mi m m m m m m mmm m moon moon
v v v v vvvv van van van van van
oar oar oar oar oar oar
i i i iiii iiiii inn inn inn inn inn
u u u uuu uuuu union union union
w w w w w w w win won win win
e e e e eee eee even invoice even vo
r r r r r r rrrrrr run ruin rover row
s s s s sssss sour soon scissors s
1 2 3 4 5 6 7 8 9 0 & $ ¢ % % @ # ✓ ¼ ½ ⅓ ¾ 1 2 3 4 5 6 7

Plate II

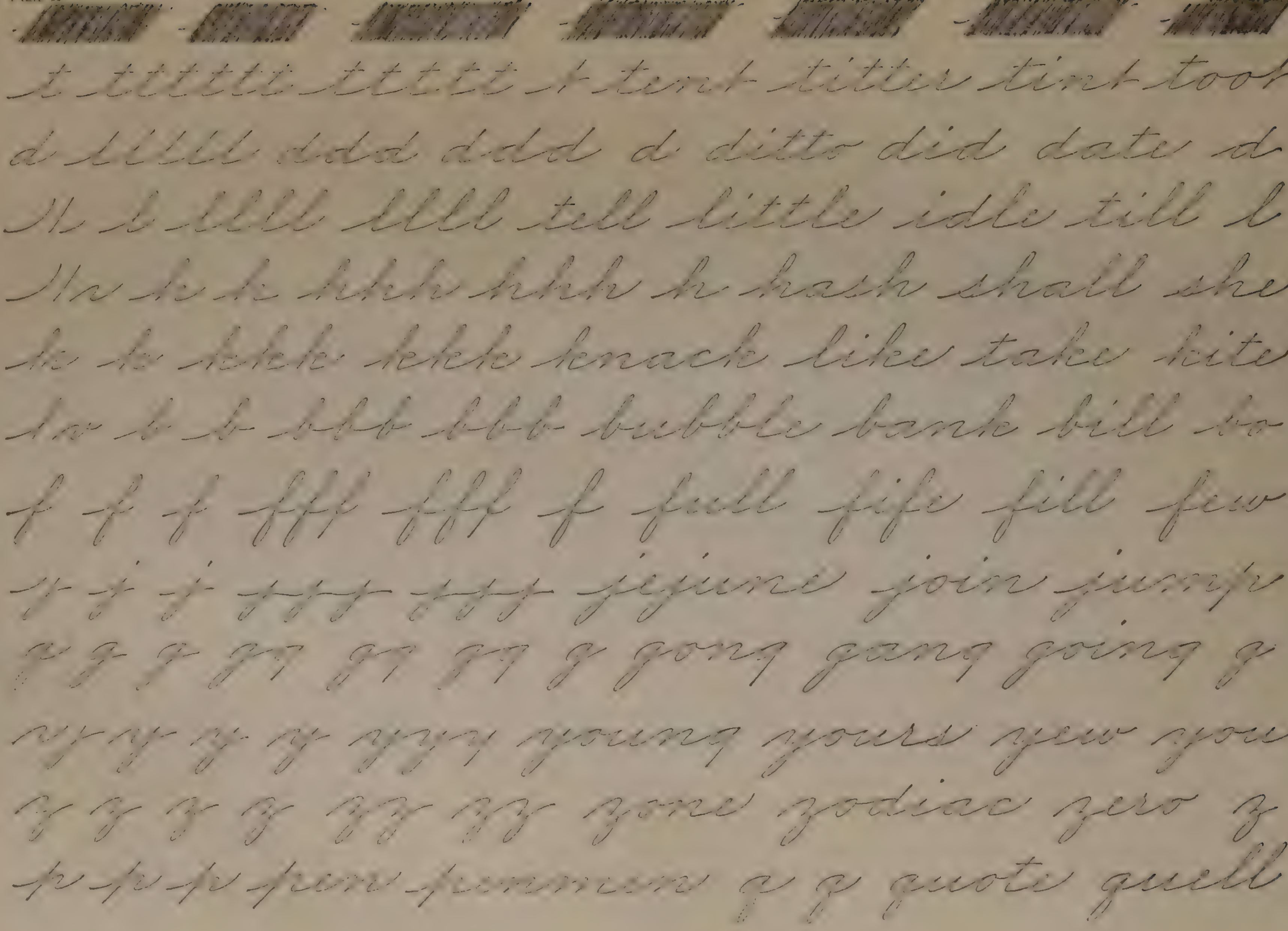
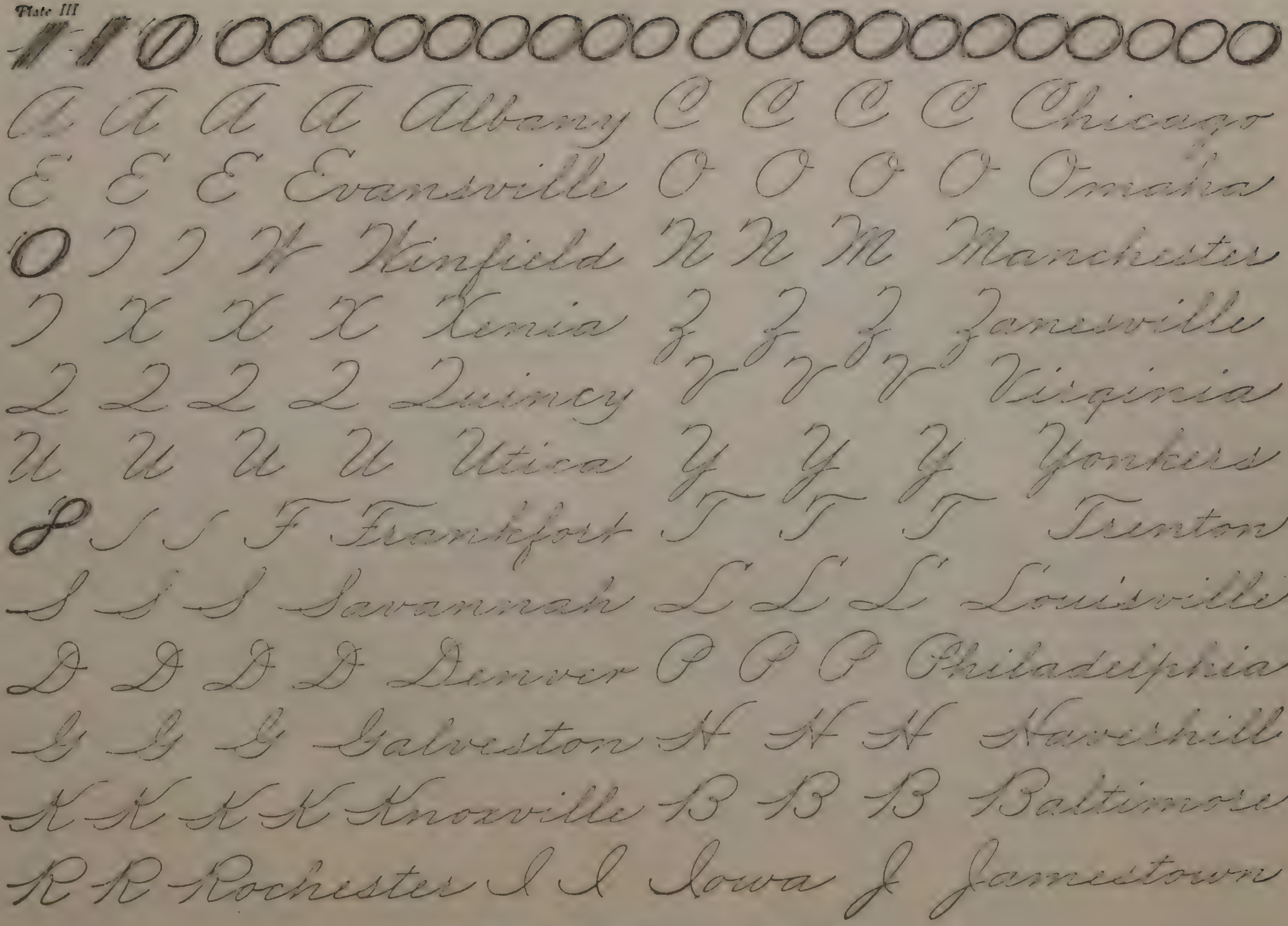

t tttttt ttttt t tent titter tint toot
d dddd ddd ddd d ditto did date d
ll l llll llll tell little idle till l
hh h h hhh hhh h hash shall she
kk k kkk kkk knack like take kite
bb b b bbb bbb bubble bank bill bo
f f f fff fff f full fife fill few
j j j jjj jjj jejune join jump
g g g gg gg gg g gong gang going g
yy y y yyy young yours yew you
z z z z zz zz zone zodiac zero z
p p p pm pmmmm q q quote quell

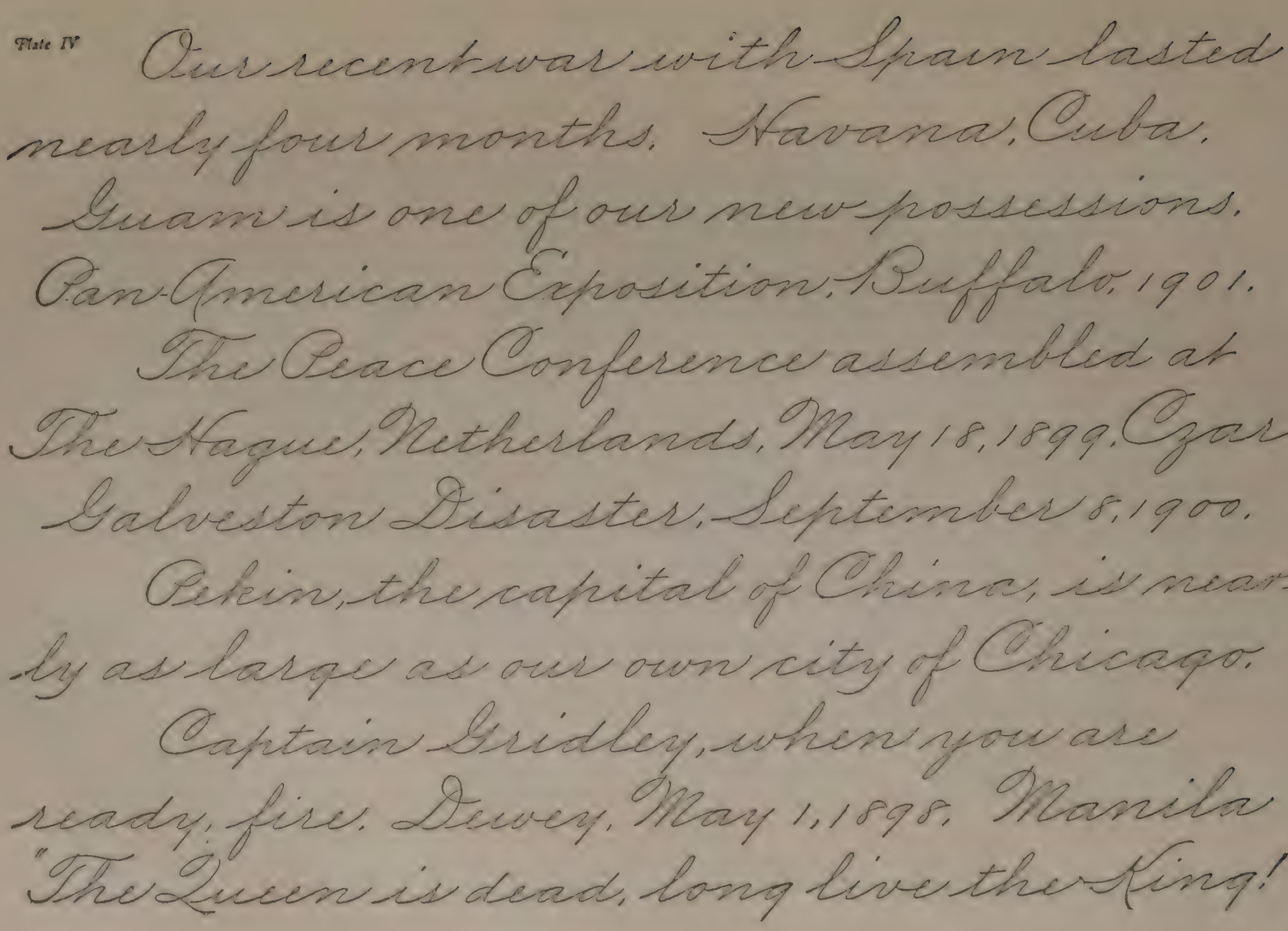
Plate III


A A A A Albany C C C C Chicago
E E E Evansville O O O O Omaha
W W W Winfield N N M Manchester
X X X Xenia Z Z Z Zanesville
Q Q Q Q Quincy V V V Virginia
U U U U Utica Y Y Y Yonkers
F Frankfort T T T Trenton
S S S Savannah L L L Louisville
D D D D Denver P P P Philadelphia
G G G Galveston H H H Haverhill
K K K K Knoxville B B B Baltimore
R R Rochester I I Iowa J Jamestown

MODEL COPIES FOR THE PENMAN

This plate and others of the series have been prepared especially for this work by Professor E. C. Mills, the expert penman and acknowledged authority on Penmanship. They give the necessary assistance for acquiring a beautiful style of penmanship. Full and complete instructions will be found in the text.

Plate IV



Our recent war with Spain lasted
nearly four months. Havana, Cuba.
Guam is one of our new possessions.
Pan-American Exposition, Buffalo, 1901.
The Peace Conference assembled at
The Hague, Netherlands, May 18, 1899. Czar
Galveston Disaster, September 8, 1900.
Pekin, the capital of China, is nearly
as large as our own city of Chicago.
Captain Gridley, when you are
ready, fire. Dewey, May 1, 1898. Manila
"The Queen is dead, long live the King!

Plate V

Cash, Merchandise, Expense, Stock;

Loss & Gain, Interest & Discount;

Bills Payable, Bills Receivable, Cr.

Inventory, Howells & Farnsworth, Dr.

Dr. Cash 1902.

				Mdse.	Gr.	Sundries	
Jan.	4	16	Mdse. a/c Sales to W. J. Womac	15	82		
"	5	10	To amt. recd. of A. N. Metz, on a/c			96	10

Dr. Langslow & Haines Cr.

190- Nov.	2	To Mdse.	17	74	40	190- Dec.	7	By Cash	15	60	—
"	5	" Sundries	9	86	20	"	9	" Mdse.	20	50	—

Plate VI

Opening a Business Letter.

Philadelphia, Pa., Oct. 4, 1901.

Messrs. Cameron & Co.
Galesburg, Ill.
Gentlemen: Yours of the 1st. inst. re-

Closing a Business Letter.

Hoping to hear from you soon, I remain,
Yours truly,
Isaac T. Johnson.

Opening a Social Letter.

Cedar Rapids, Ia., Nov. 9, 1903.

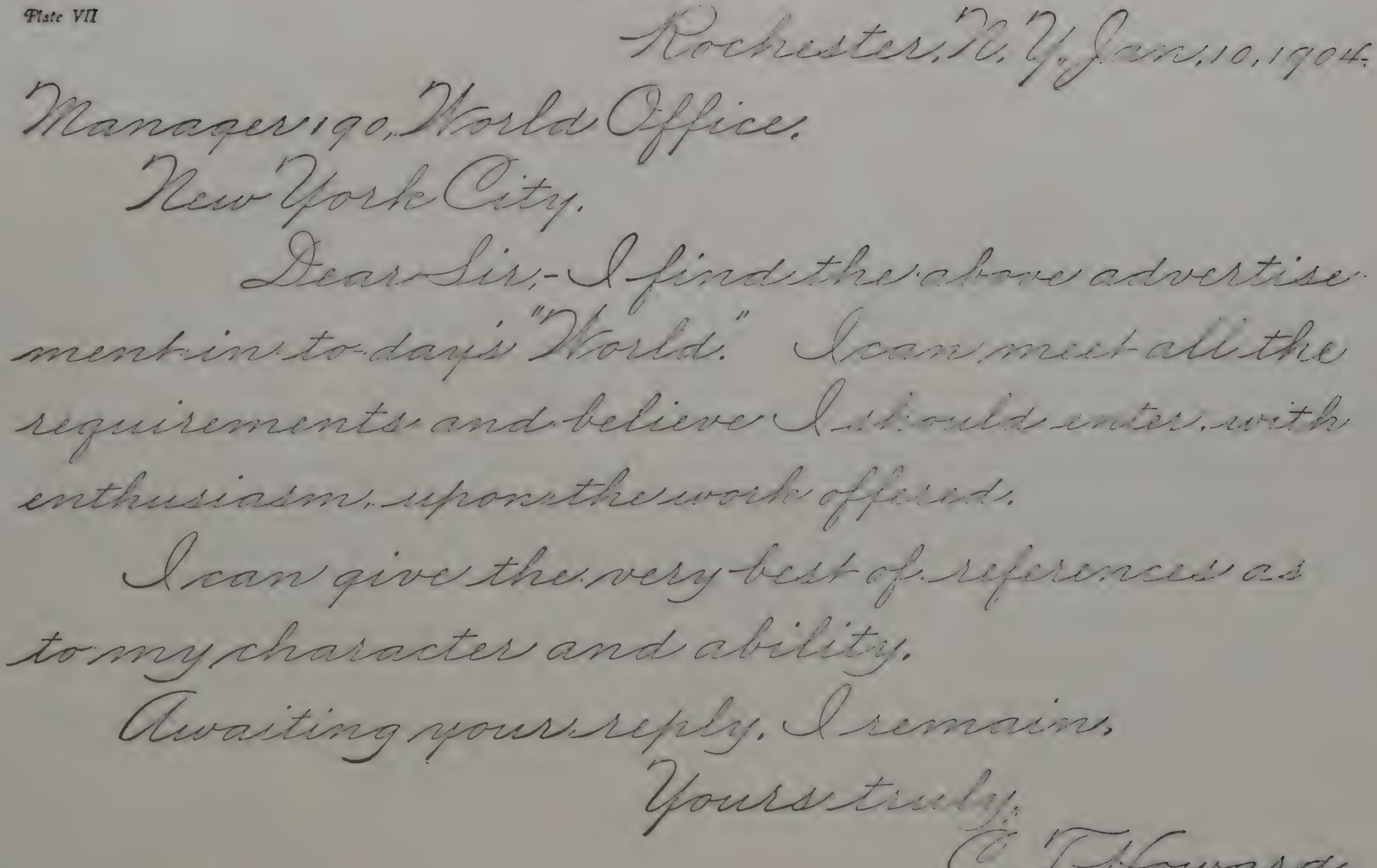
My dear Friend,
Your letter announcing your marriage to Ms. C.

Closing a Social Letter.

Believe me, my dear friend,
Ever, your loving
Grace.

Plate VII

Letter of Application for a Position.



Rochester, N. Y., Jan. 10, 1904.

Manager 190, World Office.
New York City.

Dear Sir:- I find the above advertisement in to-day's "World." I can meet all the requirements and believe I should enter with enthusiasm upon the work offered.

I can give the very best of references as to my character and ability.

Awaiting your reply, I remain,

Yours truly,
C. T. Howard.

Plate IX

Vertical Writing.

A B C D E F G H I J K L M N O P Q R S
T U V W X Y Z

a b c d e f g h i j k l m n o p q r r s s t t u v w x y z

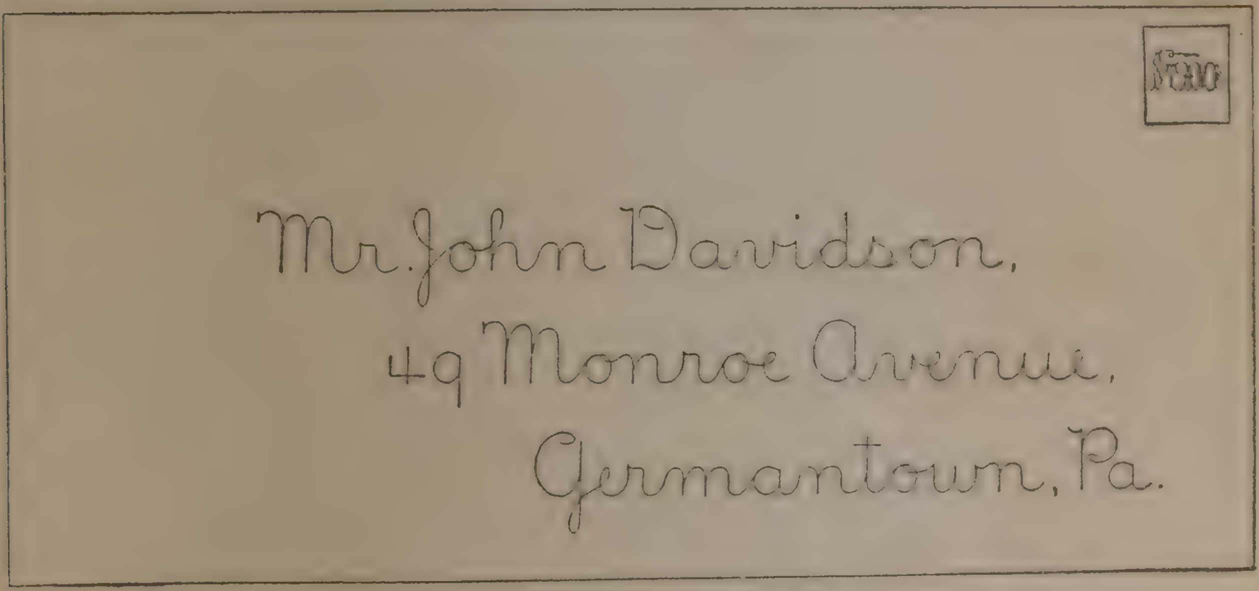
1 2 3 4 5 6 7 8 9 0 $ ¢ % % # @ √ ⅌ ½ ⅓ ¼ ¾ ? ! 1 2 3 4 5 6 7 8 9 0

"Silver and gold are not the only coin; virtue too passes current all over the world."

"No form of Nature is inferior to Art; for the arts merely imitate natural forms."

Plate X

Mr. and Mrs. Edward Rhoads request the pleasure of Mr. and Mrs. John Davidson's company at dinner, Wednesday evening, at eight o'clock. January eighth, 1903.



Stamp

Mr. John Davidson,
49 Monroe Avenue,
Germantown, Pa.

"Resolved, that the Whittier Literary Society extend its sympathy and condolence to the family of our late member, Thomas Wentworth Higginson."

Instruction for Plate I.

A great deal of time should be spent in practicing the one space letters. The different parts of each letter are illustrated in such a way that any one can see just how each letter is formed. Practice the different principles that are given for the letter, then practice on the letter itself, and after that the combination of letters as shown in the word copies or groups. The figures and commercial abbreviations should be practiced carefully. First, study the form, get a clear conception of the formation of the letter or figure, and then write with a free movement. There is a tendency sometimes with beginners in wanting to slight some of the first work in order that more difficult copies may be taken up. Be careful to work patiently on these small letters, as they are the foundation for good, practical writing. After the principles are practiced, then write a page of each letter, and follow with a page of each word containing that letter. In writing the page of word copies, see that the writing is not spread out too much, or that too wide spacing is left between words. After the proper spacing has been decided upon, see that you write the same number of words throughout the entire page.

Instruction for Plate II.

In this plate we have the loop letters. Loop letters are easily made if the right motion is used in producing them. In the formation of the loop we find the right curve and the straight line. For exercise work we have given the oblique movement exercise. Make this exercise fill one large space in height. Take up the letters and words in exactly the same order in which they are given. Do not omit or hurry over any part of this work.

One of the principal faults in forming the loop is in making the first line too straight. It should be quite a decided curve, then make the downward line practically straight. The two lines should cross about one-third the height of the loop, and be careful not to make them too long. Perhaps a little finger action would help you in making these, but let the main motion come from the arm.

Unless you can write all the one space letters as found in Plate I with the muscular movement, you will have a very poor foundation upon which to build loop letters. In your loop letters some space should be left between the top of the loop and the blue line above. If any letter or word seems very difficult, that is the one you should practice on most.

Instruction for Plate III.

In Plate III all the capital letters are presented, and they should be practiced in the order in which they are given. First practice on the movement exercises and then gradually take up one letter at a time. At least one page should be filled with each word copy. The work grows more difficult as we advance, therefore will be seen the necessity for the thorough working of the preliminary exercises before trying to make these capital letters. Do not sacrifice the movement for form; for, while you may gain some in form, you will lose in movement, without which your writing is poor indeed. After having practiced all of the work given in this plate, it is a good plan to return to some of the letters and review them. Select several of the most difficult capitals and aim to make the greatest improvement possible in those letters. Compare your work with the copy often and see that precisely the same forms of letters are used that are given in the copies. It is better to have but one style of capital letter and practice that so thoroughly that the work becomes almost automatic. You will scatter your forces too much if you try a number of optional forms in capital letters. In giving these letters for practice we have selected the very plainest forms and those that are used most frequently by business men and good business writers everywhere.

As soon as one letter is learned you should make a practical application of that form in all of your everyday writing.

Instruction for Plate IV.

There are many who can make a word or a line appear to advantage, but when it comes to a page of miscellaneous work, there is something lacking. The remedy for this is the practice of miscellaneous page work, and we hope our home students will write the work given in Plate IV over many times. There are no new capitals in this, and it will serve as an excellent copy for this class of work. Study the arrangement of your work and be sure to write with the free-arm movement. Avoid every tendency to shade or flourish, and endeavor to cultivate neatness and order in all your practice work. We believe the copies presented contain educational value aside from the practice of penmanship, and we can make our practice doubly valuable by taking up only such copies as contain important statements.

Instruction for Plate V.

The copies in this plate are such as will help those who have occasion to do work in bookkeeping. The first four lines of copies are intended to furnish material for the practice of ledger headings. The writing is made somewhat larger than that used for ordinary correspondence work, as the main thing in ledger headings is to have the work plain and legible in the extreme. Some accountants prefer to shade their ledger headings, and several examples of this kind of shaded writings are given on this plate which will show how this work is done. It requires more skill to do shading and have the work look well, and this should only be attempted by those who are quite proficient in using the pen. The writing used for explanations in bookkeeping entries should always be quite small and should never be shaded nor flourished.

Instructions for Plates VI. and VII.

In letter-writing great care should be taken that the style of writing be perfectly plain. Too much care cannot be taken in writing signatures, as often very good penmen will write their name in such a way that it is difficult to read them. Many presume that their signature is so familiar to the general public that they finish the otherwise well-written letter carelessly in that respect. Do not sign your name with flourishes, but endeavor to use the plain forms that have been given throughout the series of lessons. These forms, in Plates VI and VII, offer excellent models for practice in letter-writing, and be sure that you follow the arrangement in every respect. After practicing on these models you may make a little variation in the subject-matter and sign your own name, and in that way you will get practice that will be very beneficial to you when it comes to actual letter-writing. The only way to make a success of your handwriting is to use good writing in your everyday work.

Instruction for Plate VIII.

These forms will give you an idea how to apply good penmanship in connection with business forms. If you have blank forms similar to the ones presented herewith, you may fill them out in order to get the proper size of writing and correct arrangement of the work. Follow these copies in every particular, as they are based upon up-to-date models of business forms.

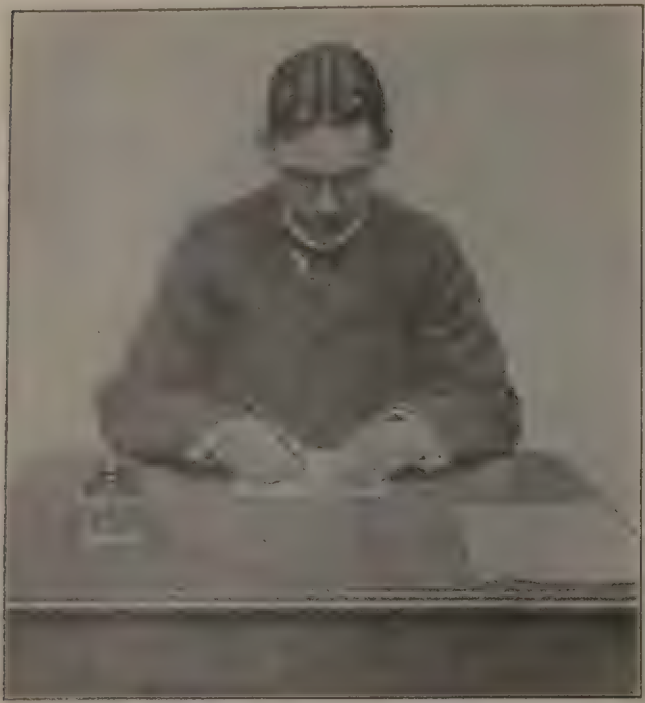
Instruction for Plates IX.–X.—Vertical Writing.

As vertical writing has been very popular in different sections of the country during the past few years, it has been thought advisable to give also instruction and practice in this style of writing.

Position for Vertical Writing.

The position for vertical writing differs somewhat from the position advised for slant writing. Notice the square front position and also that about half or three-fourths of both forearms are on the desk and that the elbows are kept quite close to the body. The paper should be held directly straight in front of the body in order that the lower edge of the paper may be held parallel to the edge of the desk. The penholder should point in the direction of the elbow, and, as will be noticed, the hand is turned more to the right than in the slant writing. The wrist should neither be flat nor turned to the right until the side of the hand touches the paper, but about half way between these two positions. Do not try to slide the hand on the tips of nails of third and fourth fingers, as this forces the hand in an upright position which makes it impossible for the student to see his own writing.

Many try to write the vertical without any change in penholding, movement, or position of the paper. Experience has shown that the results will not be satisfactory unless the change is made, so we urge that all should conform as near as possible to the position illustrated herewith.



POSITION FOR VERTICAL WRITING.

How to Produce Vertical Writing.

To produce the straight downward stroke in vertical writing, draw the pen toward the body, rolling the forearm on the muscles. To make the broad turns between the letters, roll or pull the arm back into the sleeve and to the right at the same time. As the arm should rest lightly on the desk, it may slide very much the same as the third and fourth fingers do. This, of course, cannot be done if the weight of the body is thrown forward on the arms.

Speed in Writing.

After the student has a good knowledge of form and can write all the letters with a reasonable degree of speed, it has been found advisable to practice on copies for speed work alone. Take a sentence-copy and let the student time his writing by the watch. Each time the sentence is written he should endeavor to increase in speed a little and at the same time get good form to the letters.

Patience and Perseverance in Writing.

The home student in learning to write should develop patience, and in order to secure an acceptable business hand must learn perseverance. These are two very essential qualities for success in writing. Many pupils in starting their practice on this series of lessons will perhaps write a few words of one copy and then a few words of another; perhaps they will practice a little on the movement exercises and then think that it is about time that some substantial improvement should show itself. The first few weeks of practice may tend to discourage the pupil as many write with a slow, cramped finger movement, and when the change is made to the free movement considerable is lost in form. Many give up in despair when they see that their writing is not improving perceptibly in form from the start. There will be an improvement, however, in the freedom of movement, if the instructions are faithfully followed; this is absolutely essential in learning to write a good business hand. That is the time to be encouraged, as the manner of writing is being changed, and it is right here at this critical time that the pupil must learn patience and must be persevering in his work. A few fitful hours of practice will benefit the writing but very little, in fact, it is worse than no practice at all. A definite plan should be followed as nearly as possible, and adhered to very closely if the student expects to improve the condition of his writing. From thirty to forty-five minutes a day should be spent in the practice of writing until a good business hand has been attained.

The student should remember that a good handwriting is worth hundreds of dollars to its possessor, and that nothing valuable in education was ever achieved without hard labor and many disappointments. Be patient, be persevering, work hard, and a good style of writing will be the result.

MONEY AND BUSINESS

THE COMMON MEDIUM OF EXCHANGE—MANY KINDS OF MONEY—MONEY OF ALL COUNTRIES—DIFFERENCES IN VALUES—BANKS AND BANK FORMS—HOW MONEY IS TRANSFERRED—RULES GOVERNING BUSINESS TRANSACTIONS —FORMS USED IN BUSINESS

WHAT IS MONEY

Francis A. Walker, a distinguished authority, defines money as "that which passes freely from hand to hand throughout the community in final discharge of debts and full payment for commodities, being accepted equally without reference to the character or credit of the person who offers it and without the intention of the person who receives it to consume it or enjoy it or apply it to any other use than in turn to tender it to others in discharge of debts or payment for commodities." *Currency* is the name given to the legal medium of exchange in every country.

Various articles have passed current as money in various communities at different times. *Tobacco* was used as money by the early Virginia settlers; the skins of fur-bearing animals served the same purpose in some parts of this country at a much later date. For ages gold and silver have been the first choice of all nations as the standards of value. Some one has truly said, "Abraham, 1900 years before Christ, weighed out uncoined silver in payment for land, and 1900 years after Christ gold-dust passed current as money among the 'forty-niners' in California." The standard of monetary value of the civilized nations of the world is a fixed amount of gold or of silver, which, taken together, is called bullion.

Gold and Silver Money.

In the United States the *dollar* is the unit of value, and is equal to 23.22 grains of pure gold. Therefore, when we say that an article is worth so many dollars we mean it is worth so many times as much as 23.22 grains of pure gold.

The gold coins of the United States actually contain the gold in the proportion of 900 parts gold and 100 parts alloy, and are the only form of money actually worth its face value as a commodity; therefore gold is the only money that will be accepted in a foreign country at par. The gold coins of the United States are the 20-dollar piece or double eagle, the 10-dollar piece or eagle, the 5-dollar piece or half eagle, the 3-dollar piece, the 2½-dollar piece or quarter eagle, and the gold dollar, which has not been coined since 1890 and which is now not much in circulation but considered rare.

An estimate has been made showing there is about $7,000,000,000 in gold in use in the world, and this, if put into one place, would fill a room 64 feet long, 50 feet wide, and 20 feet high. In the banks and treasuries gold coin are piled in bags each containing $5000 and weighing 22 pounds.

The silver dollar weighs 412½ grains, of which 371¼ grains is pure silver and 41.25 grains alloy. This amount of pure silver was at one time equal in value with 23.22 grains of pure gold. Of late years it has been much cheaper, and its relative value to gold is no longer 16 to 1, being determined by commercial conditions.

The half dollar, quarter dollar and dime, as well as the 5-cent nickel and the copper cent, contain still smaller proportions of silver, and are intended only for circulation in this country as representatives of the fractional parts of a dollar. They are legal tender for debts not exceeding five dollars in amount.

The standard of value are the gold coins, which stand upon their own merits as actually worth what they represent on their face. All other coins only *represent* their face value, being accepted throughout the land because they are by law exchangeable for the amounts for which they stand.

Paper Money

There is another medium of exchange not having any value in itself, but representing the credit of the government. It is, in fact, a form of "promise to pay," and for that reason it is often called "fiat money" or "paper money." Paper money is largely in use in this country, and is represented by four different kinds. The first and second are called respectively *Gold Certificates* and *Silver Certificates*. These are issued by the Treasury, and represent on their face the number of gold or silver dollars held in the Treasury of the United States payable on demand to bearer. These certificates are popular on account of their convenience, and are always worth par. The third kind is the *Treasury note* or *greenback*, which is a promise to pay the bearer on demand (therefore a demand note) without interest. There are now in circulation $300,000,000 of Treasury notes. This was called into existence during the Civil War, and for a time was not worth par in gold. Now it is worth par, as the credit of the government insures their payment.

The fourth class is the *National Bank note*, issued by banks holding a charter from the United States, and whose circulation is secured by United States bonds deposited with the Treasurer of the United States. The payment of these notes is guaranteed by the United States Government.

Gold certificates are issued in denominations of $20 and upwards.

The Silver certificates in $1, $2, $5 and upwards, to $10,000.

The Treasury notes in $1, $2, etc., to $10,000.

The National Bank notes are issued in denominations of $5 and upwards.

Money of the British Empire.

Great Britain in actual circulation has the gold sovereign (value $4.8665) and half-sovereign; the silver crown (value $1.087), half-crown, shilling (value $0.217), six-pence, four-pence, and three-pence. It has a paper currency, which includes the notes of the Bank of England, the smallest denomination of which is five pounds; the notes of the Scotch and Irish banks, the smallest denomination of which is one pound. Certain joint stock and private banks also issue notes.

CANADA has a currency similar in form to that of the United States. But she has no gold coinage of her own. She uses the gold coinage of the United States and Great Britain, and they are legal tender. The silver coins are similar to those of the United States except that there are no silver dollars and no silver five-cent pieces. There are notes issued under the laws of the Dominion of the denominations of $1, $2, and $4, and are redeemable in gold on demand. The chartered banks issue bank notes in denominations not smaller than $5. Unlike the laws in the United States, no special security in the way of deposit of bonds is required, but the notes, in case of the bank's insolvency, become a preferred claim against all assets of the bank, and include the double liability of the stockholders. The total issue rarely exceeds sixty per cent. of the paid-up capital of the bank, and in no case must it exceed one hundred per cent.

AUSTRALIA has the same monetary system as that of Great Britain.

BRITISH INDIA has a silver standard unit, which is the rupee, whose value is $0.444. It has gold coin of five, ten, fifteen, and twenty rupees, respectively. The government notes, ranging in value from five to ten thousand rupees, are issued and secured by deposits of gold and silver. The money in circulation in India is said to exceed one billion dollars.

Money in Foreign Lands.

GERMANY has a gold standard, and the mark, whose value is $0.208, is the unit of value. The 5-mark piece is the smallest gold coin. The 5-mark, 2-mark, 1-mark, ½-mark, and ⅕-mark pieces are the silver coins. Germany has a paper money which includes the imperial treasury notes, and the bank notes of the Reichsbank, a corporation owned by individual shareholders, but controlled by the government. The issue of notes of less than 100 marks in value is prohibited.

AUSTRIA-HUNGARY has recently established a monetary system making as the unit the gold crown, whose value is $0.203. The 10-crown and 20-crown pieces are in gold, and the crown and a half-crown pieces are in silver. However, there is very little metallic money in circulation. There is a paper currency issued by the Austro-Hungarian Bank in denominations of 10, 100, and 1,000 florins, and by the treasury in smaller denominations—this money is irredeemable. The value of the florin is two crowns, or about forty cents.

THE LATIN UNION, including France, Belgium, Italy, Switzerland, and Greece, has now a single gold standard, of which the franc, whose value is $0.1929, or nearly twenty cents, is the unit of value. The smallest gold coin is a 5-franc piece, equivalent to a dollar; in silver are the franc, the 2-franc, the half-franc, and the 20-centimes. The latter is one-fifth of a franc, or four cents. The coins of one country of the Union are received at par in all the others. France and Belgium have state banks which issue bank notes. In Belgium, individuals and associations are also free to issue bank notes on their own responsibility. Italy has no state bank, but there are in the country six banks which are authorized to issue notes payable on demand. The smallest denomination is 50-lire, in value, about 19 or 20 cents. Switzerland uses the coin of the Latin Union, and also has a state bank. Its central office is at Berne, and there are branches throughout the country.

IN GREECE there are three banks authorized to issue notes. But gold and silver reserves are so small that for many years gold has been at a premium.

IN SPAIN the silver peseta, equivalent to the franc, or twenty cents in our money, is the monetary unit. The gold and silver coins are the same in Spain as the other countries of the Latin Union. The Bank of Spain is the only bank of issue in the country. It is a private institution, with certain government restrictions. The smallest note of issue has the value of 25-pesetas, in our money equal to nearly five dollars.

IN MEXICO there is a silver standard. The unit is the Mexican dollar, called el peso; and, under the name of piaster, it circulates in several countries in Central and South America, Asia, and Africa. Mexico has also a few gold coins in circulation, the smallest is equivalent to our gold dollar in value.

Banks and Banking.

Banks, both national and private, offer another means of exchange. Any one having money deposited in a bank to his credit may give to a third party an order on the bank for any number of dollars and cents not exceeding the full amount of his credit. These orders on the banks are called *Bank Checks* They differ from paper money, as their acceptance depends upon the credit of the one who draws (or signs) the check. It is usually made payable "to the order of" some one. The party presenting the check must be known in some way to the bank authorities.

The use of checks adds to the circulating medium, and is a benefit to the community at large. It leaves actual money for minor transactions. They are in far more extensive use than any other form of money order. Checks often pass from hand to hand as money before they reach the bank, and then are seldom cashed—usually deposited. Over a hundred million dollars of checks daily in New York alone are not cashed at the paying teller's window, but pass in "exchanges" through the Clearing House, which is an association of the banks of a large city for the purpose of conveniently and quickly transferring checks they hold for collection. This saves an immense amount of time and labor, which would otherwise be spent in handling and counting the money, and also lessens the chances for mistakes.

Utility of Bank Accounts.

This leads us to consider the advantages of keeping an account at bank.

(1) There is the safe keeping of the money, and protection from loss by burglary. (2) It is an easy way of collecting. If the business man were obliged to send his messengers to various parts of the city or neighboring towns to collect the cash for the various checks, drafts and money orders he received, a great deal of his time would be taken. When he deposits the checks and drafts the bank does the collecting for him. The bank also collects for him such drafts as he may draw upon his debtors in distant places, charging only a small fee for the service, and sometimes without charge.

(3) It offers facilities for making payments and for saving of time in handling and counting out large amounts in bills and coin, and lessens the risk of loss by mistakes.

The merchant who keeps an account at a bank, establishes an acquaintance with the institution, and is able to borrow money by borrowing upon his notes when needed. The lending of money by discounting notes, etc., is a prominent part of the business of a bank, yet there are times when the bank will discount only for its own depositors with whose character and responsibility it is well acquainted.

How to Open an Account at Bank.

A bank will not open an account with any one who may desire it. The depositor is expected to obtain an introduction to the officers of the bank by some one who is well known to them, and to satisfy them that he is a person of proper character and responsibility. In the interview with the cashier he will be asked questions which may be answered in confidence, to satisfy the cashier of his business habits. The depositor then writes his name (just as he will sign his checks) in the "Signature Book," so that the bank may guard against forgery. The depositor then makes his first deposit, and the receiving teller gives him a pass book, with the amount entered therein.

DEPOSITED AT THE

Hanover National Bank

February 15, 1901.

By *John S. Vansandt*

	DOLLARS	CENTS
BANK NOTES, ...	*125*	
" " 1's and 2's .	*13*	
SILVER, ...	*15*	*50*
GOLD, ...	*20*	
CHECKS, ... In New York, name the Bank; out of Town, name the Place. *Please Enter Separately.*		
Chemical National	*43*	*75*
First National	*18*	*25*
Pittsburg, Pa.	*115*	*21*
Columbus, O.	*75*	*19*
Toledo, O.	*84*	
Total, . .	*509*	*90*

The Deposit Slip.—Whenever a deposit is made the depositor fills out a deposit slip, furnished by the bank, to be retained by the receiving teller and by him given to the bookkeeper. The above is one form of a Deposit Slip.

CHECKS.—A *Check* is a written demand, which is addressed to a bank by a person who has money deposited therein for the payment of a part or the whole of his money to a third party.

The Heading, the Order to pay, the Amount Repeated in figures, the Signature, and the Number of the check are the parts of a check.

The *Heading* of the check is in all respects the same as that of a letter, and includes address and date.

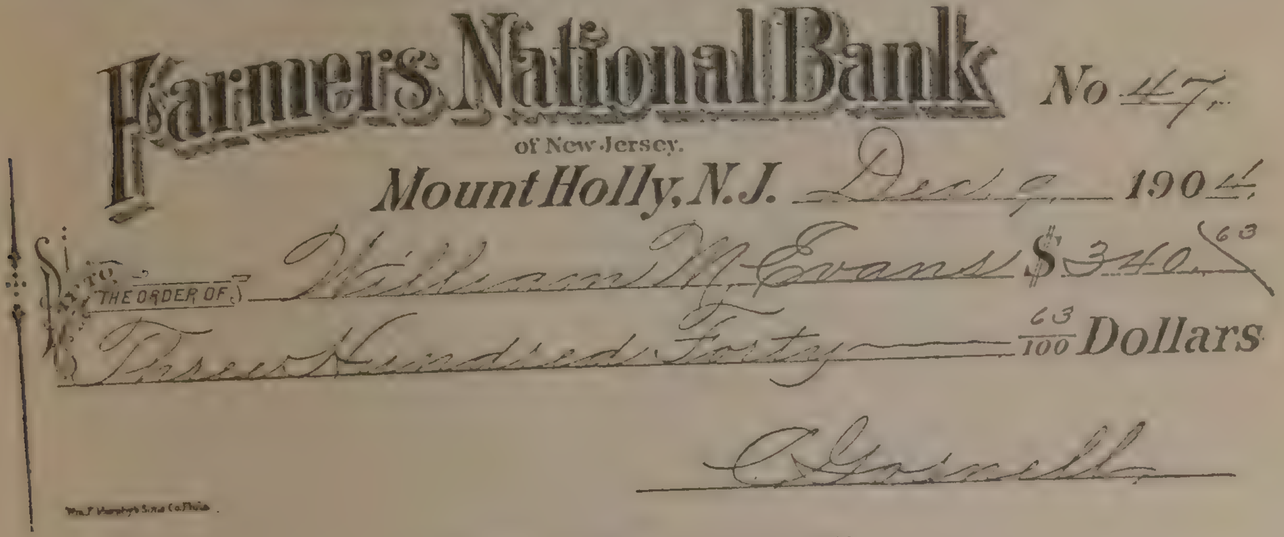
The *Order* is written beneath the heading and fills the line for the full length of the check, and usually occupies three lines. The name of the bank, printed in bold type, is on the first line; on the second are the printed words *Pay to*, which are followed by the name of the person to whom the payment is to be made, or the *payee*. On the third is written the amount to be paid, the number of dollars to be paid being indicated in script, and the number of cents, in figures as a fraction of a dollar. It is optional whether the word *and* be used between the dollars and the cents. The line generally ends with the printed word *Dollars*.

Begin with capitals the words *Pay* and *Dollars*, and all important words in the name of the bank, as well as all words expressing numbers, except such as may be connected with preceding words by the hyphen.

The *Amount Repeated* is in figures, the same in amount as mentioned in the order. But it is sometimes written in the body of the order with the script statement and sometimes in the upper left-hand corner of the check on a line with the heading. It is placed in the lower left-hand corner on a line with the signature.

The cents are expressed fractionally, as in the body of the order.

Most business men number their checks in the order they are issued. The number is found in one of the corners which is not occupied by the value of the check written in figures.



Farmers National Bank No 47

of New Jersey.

Mount Holly, N.J. Dec 9 1904

TO THE ORDER OF William M. Evans $340 $\frac{63}{}$

Three Hundred Forty $\frac{63}{100}$ Dollars

CORRECT FORM FOR CHECK

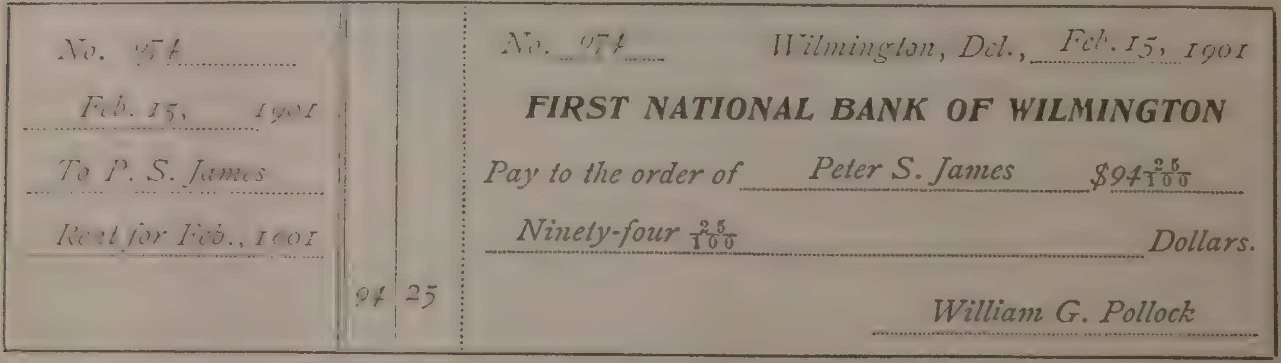
How to Draw a Check.

Checks are principally of two kinds: Negotiable and Non-negotiable.

A *Negotiable Check* is one that may be transferred from one person to another, and a *Non-negotiable Check* is one that cannot be so transferred.

In drawing a negotiable check the order may be in one of the following forms: Pay to Bearer; Pay to the order of So-and-so; Pay to So-and-so or order. The first makes the money payable to any one that may present the check. The second or third makes the money payable to any person to whom the payee may order it paid.

When the word *Bearer* is used, the check is negotiable as it stands; but when the word *order* is used, the payee can neither collect the money himself nor transfer the check to another without writing his name upon the back. This is called indorsing the check. When the payee writes his name only, he is said to indorse the check in blank. By this indorsement he makes the money payable to bearer, and the check is still negotiable. When the payee wishes the money paid to a particular person only, he writes on the back *Pay to So-and-so*, and signs his name beneath. With such an indorsement the check is no longer negotiable. But when the payee wishes to transfer the check to another, so that it can be transferred to still another, he writes on the back *Pay to the order of So-and-so*, or, *Pay to So-and-so or order*, and signs his own name beneath this. The check is now also negotiable. This may be repeated by the second person and so on, by indorsing it under the other indorsements. The *Holder* is the person who is in legal possession of a check.



No. 974

Feb. 15, 1901

To P. S. James

Rent for Feb., 1901

94 | 25

No. 974 Wilmington, Del., Feb. 15, 1901

FIRST NATIONAL BANK OF WILMINGTON

Pay to the order of Peter S. James $$94\frac{25}{100}$

Ninety-four $\frac{25}{100}$ Dollars.

William G. Pollock

The Check Stub and Check showing how record is kept in check book

How to Indorse Checks.

For indorsement, first turn the check so as to bring the left end to the top, and then turn it face downwards and write the indorsement near the top. Each successive indorsement should be written under its predecessor.

Checks are usually bound in books. At the left of each check so bound, and on the same piece of paper, is a ruled form for a complete description of the check. Between the check and this ruled form there is a line of perforations by means of which the check can be torn off for use. The paper that remains behind is called the *stub*.

Before depositing the checks they must first be indorsed. The customary form of indorsement is to write or stamp across the back of the check and about one inch from the top:

FOR DEPOSIT TO CREDIT OF
Herbert Smith

OR

FOR DEPOSIT ONLY
IN HANOVER NATIONAL BANK
FOR CREDIT OF
Herbert Smith

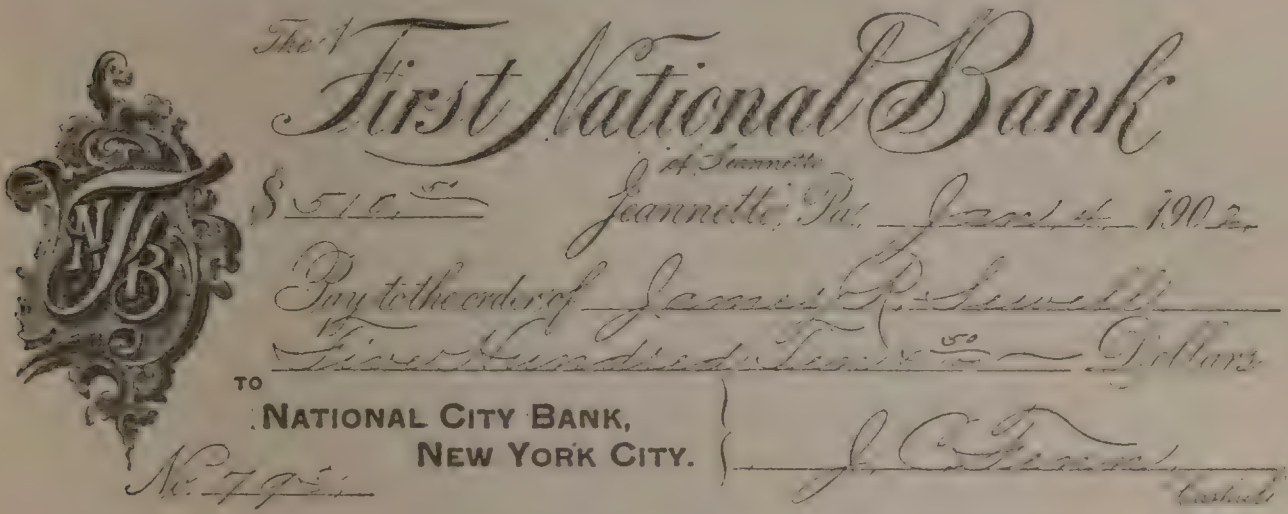
The *left* end of the face of the check is the *top* of the back. Any person named for the purpose may sign an indorsement for deposit. Checks thus indorsed can only be deposited, and should they be lost on the way to the bank the finder cannot use them, because as stated the checks are to be deposited, and the bank is not authorized to pay them to any one.

If the holder receives a check in which his name is incorrectly written, he must first indorse the name as it is written and under that write his own name correctly. When the deposit slip has been made out, it is well to keep a copy upon the reverse side of the stub of the check book. The checks, money, deposit slip and pass book are then taken to the receiving teller, who examines the deposit slip to see that it is correct and enters the amount in the pass book. This entry is his receipt for the amount deposited.

It is of the highest importance that the depositor keep his check book correctly and punctually written up. It is his guide to his bank account and he should be able to tell at once exactly how much money he has in bank at any given time.

When to Balance Pass Books.

At short intervals, the pass book should be left at the bank for settlement. The bookkeeper will enter, on the page opposite the deposits, the amounts of the checks that have been paid by the bank, and bring down the balance to depositor's credit in the bank at that time. When the pass book is returned compare the stubs in the check book and bank book at the date of settlement. If the bank book and check book do not agree, check off the deposits entered in the bank book with those in the check book; if the difference is not found, try the additions and subtractions in the check book. The bank book may show a larger balance than the check book on a certain date. This may show that some check or checks given out by you, and subtracted in the check book, have not yet been presented at bank for payment. To find the bank's balance add the amount of the check or checks to the check book balance. If this prove correct let the check book balance remain as it is, for that is really the amount there is in bank to be checked against.



The First National Bank of Jeannette

$510.50 Jeannette, Pa. Jan 4 1902

Pay to the order of James R. Sewell

Five Hundred Ten 50/100 Dollars

TO

NATIONAL CITY BANK,
NEW YORK CITY.

No. 795

Cashier

A CASHIER'S CHECK

Checks are Good Receipts.

It is evident that money is placed in a bank for safe-keeping, and that the bank becomes responsible for it. Therefore no part of it will be paid out without a check or written order of the depositor. When these checks are returned to the depositor and his pass book balanced, the bank is released from responsibility to that amount.

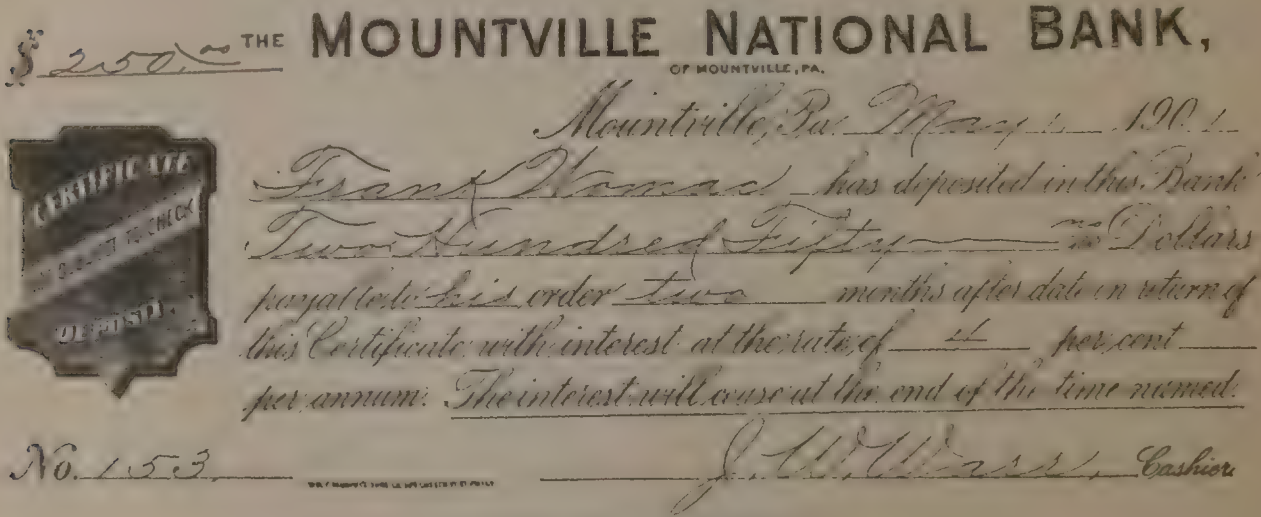
It is evident also that a check given in payment for goods or for any obligation becomes a receipt to the one who drew it; for the person in whose favor it was drawn by writing his name on the back of the check acknowledges the receipt of the money. Some persons state on the face of the check "in payment for"; but this is not good form, nor does it stand in law for more than the plain check. The checks cancelled at the bank stand as the bank's receipts or vouchers for depositor's money when returned to him or to his order.

If the drawer fails to take ordinary precautions to protect his checks from being "raised" or changed, the loss falls upon him should the bank pay the check for wrong amount.

Write your signature without flourishes and as nearly as possible like the specimen left at the bank when you opened your account. It is always desirable to write your first name rather than initial.

How Checks are Certified.

In many transactions, involving the transfer of a large amount of valuable property for cash, an ordinary check is not satisfactory to the person who is parting with his property, for he is not sure that his check will be honored when presented, however good the standing of the drawer may be. Therefore the check may be presented to the paying teller or cashier of the bank on which the check has been drawn, who, after finding that the amount is still to drawer's credit, writes or stamps across its face the words, "Good when properly indorsed," or "certified," and signs his name. The amount of the check is at once charged to drawer's account, and is the same as cash withdrawn. The certification of checks is largely practiced in large business centres, as in Wall Street, New York, where the daily sales of stocks and bonds run up into the millions, and failures caused by fluctuation in prices often come with startling rapidity. A check which may be good to-day, to-morrow may be worthless.



$250.00 THE MOUNTVILLE NATIONAL BANK,
OF MOUNTVILLE, PA.

CERTIFICATE NOT SUBJECT TO CHECK DEPOSIT

Mountville, Pa. May 1 1901

Frank Womack has deposited in this Bank Two Hundred Fifty Dollars payable to his order two months after date on return of this Certificate with interest at the rate of 4 per cent per annum: The interest will cease at the end of the time named.

No. 153 J. W. Wass, Cashier

CERTIFICATE OF DEPOSIT

When a check has been lost, in the mails or otherwise, stolen, or given in mistake, the payment of the same may be stopped by the drawer at any time before it is presented at bank. Parties holding such a check honestly, and for value given, may have recourse to law for collection of same.

Drafts and Bills of Exchange.

A draft, or bill of exchange, is, in fact, a letter written by one person to another living in a different place, requesting him to pay a sum of money to the order of the drawer or to a third person. Commercial usage recognizes particular forms for writing these drafts.

There are two kinds of bills of exchange, Domestic and Foreign.

Domestic Bills of Exchange are payable in the same country in which they are drawn, and are commonly called *Drafts*.

Foreign Bills of Exchange are payable in another country from that in which they are drawn, and are called *Foreign Drafts*.

The parts of a bill of exchange are the *Heading*, the *Order*, the *Repeated Amount*, the *Signature*, and the *Address*.

The first four of these parts correspond, respectively, in position, arrangement, capitalization, and punctuation to the heading, the promise, the repeated amount, and the signature of a check or promissory note.

The *Address*, preceded by the word *To*, is begun either on the same line as the signature, or on the next line, but as far to the left as possible. It usually includes both name and location, each of which occupies a line by itself.

The person who signs a bill of exchange (or draft) is called the *Drawer* or *Maker;* the one to whom it is addressed, the *Drawee;* the one to whom it is made payable, the *Payee;* and the person who is in legal possession of it, the *Holder*.

Bills of exchange, like notes and checks, are either *negotiable* or *non-negotiable*, according as they are payable to the order of a person or simply to the person himself. The former are the more common.

A *Sight Draft* is one payable at sight; that is, on presentation.

> *$\$257\frac{00}{100}$. Savannah, Ga., March 29, 1901.*
>
> *At sight, pay to the order of Booker Washington, Two Hundred Fifty-seven Dollars, value received, and charge to our account.*
>
> *George P. Richards & Co.*
>
> *To Theodore P. Thomas & Co.,*
> *New York City.*

A *Time Draft* is one made payable a certain specified length of time after sight or after date.

> *$\$469\frac{00}{100}$. Mobile, Ala., March 1, 1901.*
>
> *Thirty days after date, pay to the order of Sylvester Cutler, Four Hundred Sixty-nine Dollars, and charge to the account of*
>
> *John G. Cannon.*
>
> *To J. B. Smith & Co.,*
> *Phila., Pa.*

Foreign bills of exchange are usually made in sets of three, which are alike in all respects except their designations of *first*, *second*, and *third*. The three bills are usually sent by different mails, and whichever arrives first is used. The others are then worthless. These bills differ from ordinary drafts, by the insertion in each, of the condition that it is to be paid if the other two of the set are unpaid.

> *Exchange for £800.*
>
> *New York, Sept. 3, 1900.*
>
> *Ten days after sight of this First of Exchange (second and third unpaid), pay to the order of E. N. Towne, Eight Hundred Pounds sterling, value received, and charge to account of*
>
> *James H. Moody & Co.*
>
> *To Drexel, Morgan & Co.,*
> *London, England.*

Drafts are sent through banks, and not through the mails, and are used to avoid the risk, inconvenience, and expense of sending actual money from one place to another. The principal object for which it is used is to collect money due from the drawee to the drawer. For instance, if Jones, of Chicago, owes Smith, of Philadelphia, $750, Smith may draw on Jones for that amount. He will deposit the draft properly drawn with his own bank in Philadelphia, which will forward it to the bank with which Jones does business in Chicago, and which is called its correspondent. The draft when received in Chicago is presented to Jones at his place of business, who pays it by check or cash, or stamps or writes across its face :

ACCEPTED
JUNE 12, 1900.
PAYABLE AT
FIRST NATIONAL BANK.
JOHN JONES.

Or, he may write across the face simply "*Accepted*" and his name. The draft will then be paid at Jones' office when it falls due.

The draft in the former case becomes a check on Jones' account at the First National Bank when it is charged against his account. The bank in Chicago then credits and advises the bank in Philadelphia, which in turn credits Smith.

By courtesy Smith, when making the draft upon Jones, advises him at once of the fact, that he may be prepared to pay it.

If not paid, the draft is protested—that is, a formal statement of the fact of presentation is made by a notary and served upon drawer and all who have indorsed their names to the draft.

But if the drawer does not wish to incur the expense of protest fees, or to injure the credit of the debtor, there may be pinned to the draft a piece of paper with the words "No protest" upon it. This is to notify the bank presenting the draft that the drawer does not wish it protested if not paid. It is important that this slip of paper be detached before the draft is presented, or else the draft would lose its "force."

DRAFTS DIFFER FROM CHECKS.—When a draft is drawn a certain number of days after sight, or after date, it has three days of grace.

A check is practically a sight draft upon a bank; but there is a marked difference between a "check" and a "draft." For example: The form and wording are different; a check is drawn upon a bank or banker with whom funds have been deposited; a draft is drawn upon an individual or business house.

Checks are used for paying money to creditors; drafts are used as a means of collecting moneys due to the one drawing.

Checks, when properly drawn and presented, must be paid by the bank if it has funds belonging to the drawer.

The party drawn upon is under no obligation to honor a draft, if for any reason he chooses not to do so.

Due Bills.

A *Due Bill* is a formal written acknowledgment that a certain amount is due.

DUE BILL FOR MONEY.

$\$200\frac{00}{100}$. Ho Hokus, N. J., July 15, 1900.

Due Charles Stillman, on demand, Two Hundred Dollars, value received.

Henry George.

It should in capitalization, punctuation, and arrangement of parts, follow the same rules as are followed for business letters.

Due bills are often given in settling accounts, when it is not convenient to make immediate payment.

Unlike promissory notes, due bills cannot properly be made payable *to order*. They are therefore non-negotiable.

The amount represented by a due bill should be expressed twice, as in a receipt, check, or note—once in writing, and once in figures.

DUE BILL FOR MERCHANDISE.

$\$55\frac{67}{100}$. Chicago, Ill., May 12, 1901.

Due Charles F. Thomas, for work done, Fifty-five $\frac{67}{100}$ Dollars, payable on demand, in merchandise, at my store.

William C. Edwards.

Promissory Notes.

A promissory note is a written promise to pay a specified sum of money at a designated time, both of which are stated in the body of the note.

The *holder* is the person who is in lawful possession of a note, whether he is the original payee or has received the note by indorsement.

Promissory notes are divided, in common usage, into three principal kinds: Individual Notes, Joint Notes, Joint-and-several Notes. Any of these notes may be either *negotiable* or *non-negotiable*.

An *Individual Note* is one signed by a single person.

$\$240\frac{00}{100}$. Chicago, Ill., May 11, 1901.

On demand, we promise to pay to the order of Samuel Barclay, at his office, Two Hundred Forty $\frac{00}{100}$ Dollars, value received.

Henry Ambrose,
Walter Williams.

A *Joint Note* is one signed by two or more persons who are *together* responsible for its payment, share and share alike.

A *Joint-and-several Note* is one signed by two or more persons, all of whom together, or *any one* of whom *separately*, may be held for the whole amount. The words, *We jointly and severally promise*, which are found in this note, are equivalent to *We together and separately promise*. Accordingly, when such a note matures, if all the signers are able to pay, they contribute share and share alike; while if one or more cannot pay, the whole amount is paid by the remaining one or more.

> *$$851\frac{60}{100}$.   Salem, N. J., Jan. 13, 1901.*
>
> *Three months after date, for value received, we jointly and severally promise to pay William Johns or order, at the Second National Bank, Eight Hundred Fifty-one $\frac{60}{100}$ Dollars, with interest.*
>
> *Henry Swartz.*
> *Levi Douglass.*

A note is made negotiable, that is saleable, by making it payable to a person, or his order, or to his assigns, or to bearer, or to the cashier of a bank or incorporated company. A note so drawn may be negotiated, or used in payment to another person by the holder; but he must indorse his name on the back of the note. Should the drawer of the note fail to pay it, the holder looks to the person or persons who indorsed it for payment.

A note payable on a certain day is usually due three days later. These three days are called *days of grace*. Thus a note for one month, dated March 1st, need not be paid until April 4th, the last day of grace. Notes payable on demand are not entitled to any grace. Should the last day of grace fall upon Sunday or upon a legal holiday, it must be paid on the day previous. Thus a note due December 25th, must be paid on the 24th of that month.

A note made payable at a bank and held there for payment until the usual hour for closing, need not be presented to the drawer in person to bind the indorser. It may be protested as in the case of drafts, immediately upon the close of bank-hours. Payment must be immediately demanded of the indorser if he resides in the same place; if he is a non-resident he must be notified at once by letter.

Discounting Note at Bank.

When notes are offered at bank they are passed upon by its officers or directors, or both, to satisfy themselves that the maker and indorsers are good for payment. If accepted the bank charges interest or discount at an agreed upon rate reckoned upon the face of the note for the time for which the note is to run from the day it is discounted. For instance a note for $500 drawn and dated April 1, 1901, payable in 3 months, would be due and payable July 1st or 4th. If offered at

> *No.* 114   *Amt.* $1300
> *To* Alfred Sidney
> *For* On ac.
> *Payable* Merchants' N. Bank
> *Time* 3 mos.
> *Due* June 13, 1901
>
> *$$1300\frac{00}{100}$.   Nyack, N. Y., Mch. 13, 1901.*
>
> *Three months after date, for value received, I promise to pay to the order of Alfred Sidney at the Merchants' National Bank, Thirteen Hundred $\frac{00}{100}$ Dollars.*
>
> *Wm. B. White.*
>
> *No. 114.*

A Promissory Note and stub, showing record of note. This record may also be kept in separate book for notes payable and receivable.

bank for discount on May 1, 1901, the bank would reckon the interest from May 1st to July 4th. It is to be noted that the bank takes its interest in advance and pays to holder of note the proceeds which is the face value less the bank interest or discount. To compute the value of a note which reads "*with interest*," you add to the face value the interest which will be due at the maturity of note. Upon this value the bank reckons its discount.

Indorsements, a Summary.

Indorsements are entries written on the back of any paper, whether checks, notes or drafts. They show either a transfer of title, a giving of security, or a receipt for a payment applying on the contract indorsed.

We give here, plainly marked, the various forms of indorsements:

No. 1 is the more common and safest form. It transfers the ownership from Smith to Jones, and makes Smith responsible to Jones in case the maker or payer of the paper fails to pay it.

No. 2 transfers ownership, but relieves Smith from any responsibility if the paper is not paid when due. Only under special circumstances is this used.

No. 3 transfers the ownership to any party who may hold the paper, making it in effect payable to the bearer. Such paper should not fall in hands of strangers.

No. 4 transfers the ownership as in No. 3, except that it relieves Smith from further responsibility.

1 *(Transfer of Title.)*	Pay to the order of Henry Jones. JOHN SMITH.
2 *(Without Recourse.)*	Pay to Henry Jones, or order, without recourse. JOHN SMITH.
3 *(In Blank.)*	JOHN SMITH.
4 *(Blank—Without Recourse.)*	Without recourse. JOHN SMITH.
5 *(For Money paid.)*	Oct. 4, 1900., Received on within note Fifty ($50) Dollars.
6 *(For Collection.)*	Pay to the order of the Commercial National Bank of Lansing Mich., for collection. JOHN SMITH.
7 *(Protest Waived.)*	Notice and protest waived. JOHN SMITH.

When a paper is written payable to the order of John Smith, and he wishes to transfer his title to Henry Jones, he writes on the back of the paper an order for its payment to Jones.

For the convenience of bank-tellers and others who have large numbers of such indorsed papers to handle daily, it is well to write the indorsement across the left end of the paper.

On negotiable papers that are likely to have several indorsements, care should be taken to write the indorsements as close together as is convenient. If the back of the paper should be covered with indorsements, other indorsements can be written on blank paper attached to the original.

No. 5 is a receipt for money paid to apply on the promise indorsed. Such indorsements need no signature as it might have the effect of a receipt in full.

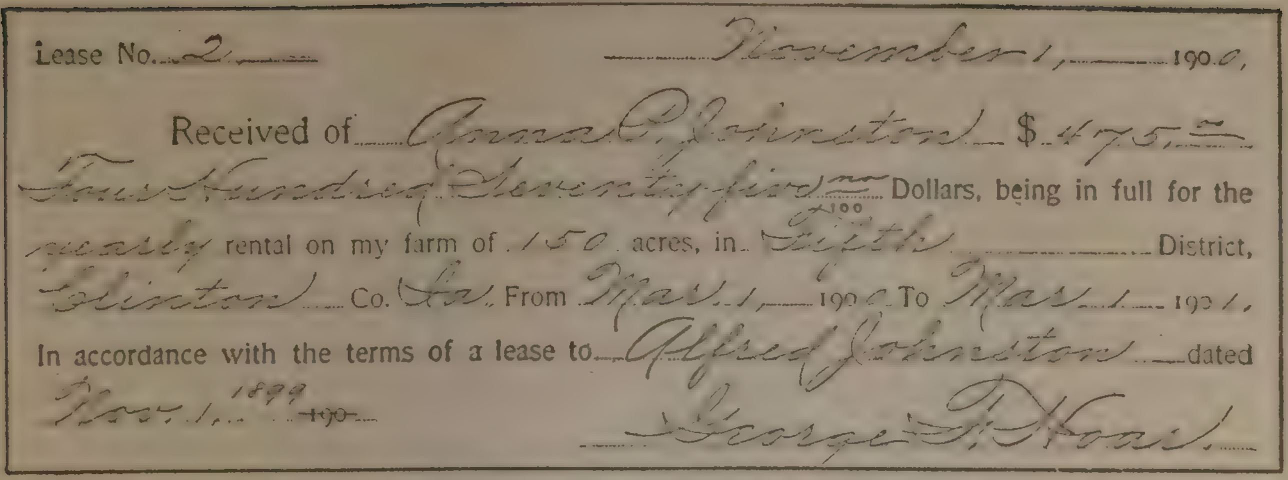
No. 6 does not transfer the ownership of the paper, but merely gives authority to collect the paper as Smith's agent and to place the amount collected to his account.

No. 7 relieves bank of responsibily of serving notice and protest.

Receipts.

A *Receipt* is a written acknowledgment, signed by the receiver and delivered to the giver, showing that certain property (money or goods, or both) has been received.

RENTAL. RECEIPT.



Lease No. 2 November 1, 1900,

Received of Anna C. Johnston $475 $\frac{00}{100}$

Four Hundred Seventy-five $\frac{00}{100}$ Dollars, being in full for the yearly rental on my farm of 150 acres, in Fifth District, Clinton Co. Ia. From Mar. 1, 1900 To Mar. 1 1901, In accordance with the terms of a lease to Alfred Johnston dated Nov. 1, 1899 ~~190~~

George F. Hoad.

Every word which expresses number, unless connected with preceding word by a hyphen, may or may not begin with a capital. But there should be uniformity in this particular in papers drawn by same parties. The amount of money received is written in figures in the left-hand corner.

There are three kinds of receipts: (1) *Receipts in Full;* (2) *Receipts on Account*, and (3) *Receipts to Apply on Particular Accounts.*

The first is given when the payment is a complete settlement; the second, when partial payment of a debt is made; the third, when there are more accounts than one between the persons, and the payment is intended to apply to a particular one.

(1)

457\frac{00}{100}$. Akron, O., Jan. 12, 1901.

Received from George B. Waterson, Four Hundred Fifty-seven Dollars, in Full of all Demands.

Albert S. Lucien.

---

(2)

341\frac{00}{100}$. Wilmington, Dela., Nov. 10, 1901.

Received from Lyman D. Willard, Three Hundred Forty-one Dollars, on account.

Charles F. Gibson,

Per Anna Brown.

---

(3)

375\frac{75}{100}$. Portland, Ore., Aug. 17, 1901.

Received from B. Braddock, Three Hundred Seventy-five $\frac{75}{100}$ Dollars, to apply on rent of house.

Frank Berry.

[BILL OF SALE]

IN CONSIDERATION OF

Two Hundred Seventy-four . . . DOLLARS, receipt of which is hereby acknowledged, *I, S. D. Haag*, of County of Erie and State of Pennsylvania, do hereby sell and convey unto Peter Cline, of County of Erie, and State of Pennsylvania, the following described personal property.

Dark Bay Horse, "Nepos," 17½ *Hands High*, 1600 *lbs. weight, with star on forehead and white on right hind foot.*

And I do hereby covenant and agree to warrant and defend the above described personal property against the lawful claims af all persons.

Signed this 5th day of May, A.D. 1902,

S. D. HAAG.

Knowing Values

The successful man or woman of to-day in business and social life is the one who understands and can appreciate values. The man or woman who knows the rules of business and of commerce is better fitted for success than one who does not. No better illustration of this can be given than the bargains between the traders and the Indians in the past. Valuable skins or concessions were given by the Indians for worthless but apparently attractive trinkets. People to-day who do not understand the methods of business are less apt to succeed in making satisfactory trades for themselves than the persons who understand the laws of trade. This book tells how business is conducted and gives the safe methods.

(ITEMIZED BILL RECEIPTED)

Los Angeles, Cal., *October 31,* 190–.

M*r.* *EBEN HOLDEN*

To R. E. CARTWRIGHT & CO., Dr.

Accounts Rendered Monthly.

October	*2*	*14 yards Silk*	*at $1.60*	*$22*	*40*		
		7 " Lining	*" .18*	*1*	*26*		
		½ " Braid	*" .20*		*10*		
		26 " Muslin	*" .12½*	*3*	*25*		
		2 doz. Buttons	*" .37½*		*75*		
		15 yards Flannel	*" .33⅓*	*5*	*00*		
						$32	*76*

Received payment,

Nov. 15, 190–.

R. E. CARTWRIGHT & CO.
Per. Bowers.

Making Out an Account and Receipting Bill.

When merchandise is sold or services are rendered a detailed statement should be made out. This is called a bill, or an account. The *debtor* is the one who owes the money, and the *creditor* the one who receives it. Goods are said to be sold on account or credit when they are not paid for on delivery.

Business Correspondence.

Great importance attaches to business correspondence, for a large part of the world's business is done through the mails or by telegraph. To facilitate the handling of so much mail it is important that business letters should have a uniform style and one which will secure clearness and accuracy in statement. Before giving a few model forms we would call attention to the following points, which we may term

Essentials for a Business Letter.

Use good paper and envelopes and black ink.

Study to arrange your letter to give it the best possible appearance, leaving a margin of a half inch or more at the left of the page, and dividing the letter into paragraphs whenever a new subject is to be considered.

Re-write the letter rather than to have erasures or blots.

Do not write the letter with a pencil, and do not use foolscap paper.

Fold the letter neatly to fit the size of the envelope.

Use as few words as possible and state clearly what you have to say.

Give the address plainly, including street or post-office box, town, and state, or province. Address the envelope carefully and examine before sending.

Read the letter when written to assure yourself that there are no omissions or mistakes.

Keep copies of all important business letters and file letters received.

When writing to others for information enclose a stamp or prepaid envelope.

In writing letters requesting payment, employ only the most gentlemanly terms and polite language.

When addressing strangers use "Sir" or "Dear Sir." A married lady is addressed as "Madam" or "Dear Madam," an unmarried lady as "Miss" or "Dear Miss;" it is allowable also to say "Dear Madam." In writing to a firm, company, or a number of persons the address is "Gentlemen" or "Dear Sirs." Never use the abbreviation "Gents."

In replying to a letter first acknowledge its receipt and mention the date. Use sparingly contractions and abbreviations.

The closing words of letters should be "Yours truly," "Yours respectfully," "Respectfully yours," or "Respectfully."

How to Begin a Letter.

We give below a few forms for beginning letters, where the paper is not provided with a printed heading. The first line on ruled paper is generally about an inch and a half below the top of the page. This is the proper place to begin. On the first line, beginning near the center of the paper, is written the name of the town and state, or the number of the street, with the name of the town and state on the second line. On the line below follows the month, day and year; on the succeeding line, at the left, the name of the party to whom the letter is addressed; the next line or two lines are occupied with his post-office address, and on the following line the address proper, "Dear Sir," etc.

Kokomo, Ind.
October 25, 1903.
Mr. J. T. Terhune,
Lancaster, Pa.
Dear Sir:

We are pleased to acknowledge the receipt of your letter of the 10th inst., etc.

Kennet Square, Penna.
April 2, 1904.
Messrs. Kent & Tatnall,
211 Market Street,
Philadelphia, Pa.
Gentlemen:

Please ship me the following order of goods, etc.

Closing a Letter.

Never fail to sign a letter, using your full name, and write it clearly, that there may be no error in sending your reply. If a lady is writing to a stranger she should sign her name with her proper title "Miss" or "Mrs." preceding in parentheses. There are various forms of closing letters, of which the following are the more common:

Yours truly,
(Miss) Mary Jones.

I remain,
Yours respectfully,
E. G. Ziegler.

I am,
Yours truly.
Robert M. Worth.

To Charles M. Jones,
Ogontz, Pa.

How to Address an Envelope.

Commence the name a little to the left of the centre of the envelope, and about one-half way down from the top. Write the name of the party addressed, with the number of the street on a line below, a little to the right, the city or town on a line next below and to the right, and last the state or province. The county may be placed in the lower left hand corner. The following is an example:

J. H. HOUSTON,
98 Adams Street,
Toronto,
Canada.

We give here a few letters as models of the most common forms which occur in business. These will be sufficient to suggest what forms may be adopted for others.

Letter of Application.

749 Monroe St.,
Milwaukee, Wis.,
December 20, 1901.
Messrs. Gerhart & Co.,
121 La Salle Ave., Chicago.
Gentlemen:

I notice in this morning's "Eagle" your advertisement for a salesman, in reply to which I am pleased to offer my services.

I am twenty-nine years of age, and have had four years' experience in one of the leading houses of Milwaukee, in the employ of Messrs. Galt, Smith & Co., to whom I *respectfully refer you. I also enclose to you copies of letters of recommendation, which I trust will be satisfactory to you.*

I *shall be pleased to arrange for an interview with you, if that be your pleasure. Awaiting your early commands, I am,*

Very truly yours,
Emery Earles.

A Letter Ordering Goods.

179 Jerome Avenue,
Guelph, Ontario,
January 5, 1902.

Messrs. C. B. Smith & Co.,
Toronto, Canada.

Gentlemen:

Please send me by express, as soon as convenient, the following books:

1. *Tennyson's Poems (Complete.)*
2. *Thomas' Algebra.*
3. *Hopkin's History of Canada.*

Please advise me of shipment and send an itemized bill, allowing the usual discount.

Very respectfully yours,
John A. Hewes.

Letter Asking for Settlement of Account

Toronto, Ontario,
April 1, 1902.

Mr. John A. Hewes,
Guelph, Ont.

Dear Sir:

We enclose a statement of your accout somewhat overdue, and shall feel greatly obliged for the settlement of the same at an early date, as we have several heavy payments to make.

Trusting that you will excuse us for troubling you, we are,

Very truly,
C. R. Smith & Co.

Enclosing Statement of Account.

Cincinnati, Ohio,
April 1, 1903.

Messrs. Allibone & Simmons,
Terrehaute, Ind.

Gentlemen:

We enclose you herewith statement of your account for the last three months, which we believe you will find correct. We shall be glad to have you examine the same at your earliest convenience, and shall be happy to receive your check for the amount, or instructions to draw on you in the ordinary course.

We are, gentlemen,
Yours very truly,
R. C. Bancroft & Co

Enclosing Remittance.

Boscobel, Wis.,
June 21, 1903.

John Wanamaker,
Philadelphia.

Dear Sir:

The goods ordered of you on the 5th inst. have been received and are entirely satisfactory in both quality and price. I enclose you herewith my check for $175.91, the amount of your bill, which kindly receipt and return.

Very truly yours,
Thomas Upton.

Opening an Account.

Jefferson City, Mo..
September 15, 1902.

Messrs. R. B. Smith & Co.,
St. Louis, Mo.

Gentlemen:

I desire to open an account with you as I expect to have need to order frequently goods of the lines you carry, and it will be more convenient for me to settle the first of each month than to make remittance with each order. I am permitted to refer you to Dr. C. F. Peterson, 99 Monroe Street, of your city, who knows me well, and also Brown & Johnson, bankers of this city, who are well acquainted with my financial standing. Should my references prove satisfactory, will you kindly forward me at once by express, the following goods:

3 dozen Napkins at about $3.00.
2 boxes Ladies' Fine Hose.
3 dozen Ladies' Hemstitched Handkerchiefs at about $2.75.
15 yards of Gingham, light color about 18 cents.

Hoping my proposition to open an account will be satisfactory, and that the enclosed order may meet with your prompt attention, I am

Yours respectfully,
Peter Andrews.

Acknowledging Receipt of Order.

OFFICE OF
R. B. SMITH & CO.
200-25 DAUPHIN ST.

St. Louis, Sept. 21, 1902.

Peter Andrews,
Jefferson City, Mo.
Dear Sir:

Your favor of the 15th is received.

The references are quite satisfactory and we shall be pleased to have your account.

The goods ordered are now being packed, and we will ship them per Illinois Central tomorrow.

Thanking you for the order, and hoping your goods will reach you promptly and in good condition, we remain,

Very truly yours,
R. B. Smith & Co.
per S.

Practical Points for the Correspondent.

Abbreviations.—Use only authorized abbreviations, and attempt no short cuts of your own. Consult a dictionary when in doubt. Do not say "Phil." for "Philadelphia," or "G'n't'n" for "Germantown." Use "and," not the sign "&." Abbreviations denoting professional standing, as "M. D.," "D. D.," "LL. D.," and "M. A." are used chiefly on title pages. When used on letters the names are not preceded by titles such as "Mr.," "Professor," etc.

Address.—The name and address should be written plainly so that "N. Y." will not be mistaken for "N. J.," "Mo." will not be mistaken for "Me.," "Md." for "Ind.," nor "S. C." for "S. D."

Avoid fancy note paper. Avoid postals for private correspondence. Avoid flourishes. Avoid crooked lines. Avoid unusual colors in inks. Avoid grumbling on paper. Avoid slang. Avoid the capital "D" in "My dear Sir." Avoid erasures and blots. Avoid writing with pencil. Avoid frequent repetition of the same word. Avoid too many "and's" and "very's" and "so's" and "well's." Avoid the use of figures instead of words denoting numbers. Avoid awkward folding of the letter. Avoid matters of private confidence and friendship in business letters. Avoid delays in answering invitations. Avoid displaying temper in letters.

Dating Letters.—It is important to date the letters at the beginning, that it may not be overlooked, giving the day of the month and the year. The correct contractions for second, third, etc., are 2d, 3d, etc. In referring to other dates, "inst." refers to the present month, "ult." to the preceding month and "prox." to the following month, as "23d prox." means the 23d of next month. Care should be taken in using these abbreviations.

Initials.—Full names, not initials, should be used. It is difficult to know whether "R. Jones" means "Reuben Jones" or "Rebecca," or whether the writer should say "Mr. Jones" or "Miss Jones." One's own name should always be written legibly. Only cashiers are allowed fancy signatures.

Materials.—The best stationary only is good enough. Paper and envelopes should correspond in color and quality. Business letter sheets are either 5x8 (note size) or 8x10 inches (letter size.)

Mistakes.—Over 5,000,000 letters go astray each year on account of mistakes in envelope addressing. Letters are sent with money enclosures and orders for goods, which the sender never hears from, for there is no address in the letter, or the signature may be omitted; therefore, don't make mistakes.

Official Letters.—It is better to say, "To the Commissioner of Patents, etc., Sir," than to say "To the Honorable A——— S———, Commissioner of Patents, etc.," and if the writer is an official, it is proper for him to place his title after or below his signature.

One Side.—Write on one side only of the paper in business correspondence, that copies may be easily taken.

Ordering Goods.—Give complete directions as to method of shipment, whether by railway or other transportation, and state explicitly the kind and amount of goods you wish shipped. Also state the amount of money you enclose in your letter, or how it will be sent.

Return Postage.—In writing about your own affairs, requiring an answer, it is proper to enclose a stamp or stamped envelope.

Spelling.—A small dictionary of common words is an important adjunct to everyone's writing desk. Good spelling only comes from practice and experience in careful reading.

Style.—The general appearance of a letter depends upon the degree of attention given it as to its legibility, correct spelling, paragraphing and punctuating, and also to the freedom from blots, interlineations and erasures. Style also depends upon the beginning and ending of the letter, that they be uniform and artistic in arrangement.

Telegrams.—Correspondence by telegraph is expensive, and such communications are called "messages." They should be brief, concise, and give exact meaning. They should not omit necessary words or be capable of more than one meaning. It is always best to write carefully what you wish to state, recast it, if possible, to say the same thing in fewer words. See that the name and address are plainly written, and your own name and address are signed. Omit all forms of salutation at beginning and close of the message. The following shows a concise message:

Philadelphia, Pa.

John W. Ferris,
Central Block
Pueblo, Colorado.

Father very ill. Come immediately. Draw on me for funds.

WILLIAM FERRIS.

PRACTICAL BOOKKEEPING

WHY ACCOUNTS ARE KEPT—PROFITS AND LOSSES—RECORDS OF BUSINESS TRANSACTIONS—SINGLE ENTRY BOOKKEEPING—A MODEL SET OF ACCOUNTS—DOUBLE ENTRY—THE BOOKS USED—A MODEL SET OF DOUBLE ENTRY ACCOUNTS—TRIAL BALANCES

THE SCIENCE OF ACCOUNTS

Bookkeeping is both a science and an art. It is based upon custom and utility, the principles of which have been formulated into general laws, which have been adopted throughout the business world. In this sense it is a science. The recording and mechanical part, including the accuracy in arrangement of business transactions, is the art. To become efficient in both the science and the art it is necessary to master the principles and laws and apply them with accuracy and rapidity.

The object of bookkeeping is to keep an exact record of the amount of money, merchandise and other properties received and disposed of, and the amount of each on hand.

Bookkeeping is practiced in two ways or methods, which are known as *single* and *double* entry. In opening up a business, the business itself is the first thing to be considered; the recording or specifying the transactions is secondary. The former will determine largely the method to be followed.

Every man, whether he be a laboring man, farmer, tradesman, or professional man, should keep a record of all dealings which require a record of the receipt and expenditure of cash. Every wage-earner should take a few minutes at the close of each day to make a record of his cash, as well as the articles he has purchased during the day and had charged. When this is done there will be great satisfaction in knowing how the money has been spent, and oftimes much assistance in checking needless expenditure. A farmer can make use of a simple form of bookkeeping in keeping a record of the cash he receives for the different products of the farm, and the cash expended for improvements, for material, and for labor. It will not be difficult for him to determine with great certainty which department of farming that he has tried yields the best returns. He should open an account with each one of his laborers, entering under the name a memorandum of the terms of the agreement, with the former address of the employee. In keeping an account with a person to whom goods are sold, when the account is paid in full it should be closed. If only a part is paid, credit should be given and the account closed, with the balance brought forward. A farmer can also, as we have said, keep an account with any department of his work, such as his wheat field, his corn field, or his cattle, charging to each the labor, seed, fertilizer, etc., and crediting to it the returns from the sale of the crop and the value of such portions as may have been used on the farm. In the same way, a mechanic should keep an account of each piece of work that he undertakes, especially if it be on contract, that he may ascertain the amount of his profit or loss. This will be a good guide to him for future estimates. These accounts are commonly called Property Accounts, and may be kept in the same form as used for Personal Accounts, that is, accounts kept with individuals.

The Books Used in Single Entry Bookkeeping.

The different books used in bookkeeping will be learned as we follow the forms given on the succeeding pages. The three important ones are:

The Cash Book. This is used to show all receipts and payments of cash, and also all personal debits and credits for cash, which must be entered in the ledger.

The Day Book. This book is used to keep a record of transactions for which cash is not paid or received, but the amounts of the transactions are to be entered in their proper places in the ledger, as indicated in the day book. Every transaction entered in the day book indicates that the person or account so entered is either debtor (Dr.) or creditor (Cr.) in reference to the one who owns or manages the business represented by the book. This book is generally ruled with two amount columns, the first being for the items of transaction, and the second for the total of these items.

The Ledger. This is not a book of original entries, but is a record of what has been first entered in another book, such as the *Cash Book* and *Day Book*, *Notes Receivable* and *Payable Books*, *Blotter*, and such other books as may be required, depending on the nature and extent of the business; hence, items do not appear in the ledger; but in a column ruled for that purpose is placed the folio or page of the book from which the entry is posted, as entries made in day book and cash book give a history of the transaction. They are sometimes called *Historical Entries.*

It is best to observe the following directions for entering items in the cash book and day book:

1. Be uniform in describing transactions of the same kind.

2. Every transaction should have an entry made on the day on which it occurs.

3. The quantity and price of each item should be given in entering sales on account; likewise in recording purchases on account.

4. Do not erase or interline any entries made in cash book or day book. If any errors are made mark them "Void" and make the entry a new one. This will show that no fraud was intended if the books are examined in court. Corrections and erasures may be made in ledger and other books, although these should be avoided.

5. Exercise great care in writing figures, as corrections cannot be easily made.

Single Entry Bookkeeping.

Single entry bookkeeping is simple, and is generally adopted by shop people and small concerns who deal in a great variety of articles and where the sales are small and numerous. This method affords some knowledge of the condition of the business to the proprietor; by this system it often seems a tedious method to enter each sum singly in the ledger. The ledger contains the names of all parties with whom transactions take place. The debtor and the creditor accounts of each party are arranged on the opposite pages, the debtor being on the left-hand side and the creditor on the right. Thus, if merchandise is sold to A, A is made debtor (Dr.) to merchandise and merchandise is made creditor (Cr.) to A. The key to bookkeeping is found in the following: *Debit what is received or what costs value; credit what is parted with or what produces value.* The person from whom you buy goods or receive money is the *Creditor*, and those to whom you sell goods on credit or pay money is the *Debtor.* When a thing is received its account is debited; when cash is received, cash is debited; merchandise, merchandise is debited; hence, when a person receives something of value from us without giving value in return we debit that person. When cash is paid out, cash is credited; merchandise is sold, merchandise is credited.

The cash book not only is very useful, but quite essential whether kept by single or double entry. When you receive money you enter it on the debtor's side or left-hand page; when you pay out money you enter the sum on the credit or right-hand page; the difference between two sides of a cash book will always show a debit balance which is equal to amount of cash on hand. The credit side of the account can never be larger (unless your account is overdrawn) than the debit side, since it is impossible to pay out more cash than has been received. To close the cash account write on the credit side, in red ink, the total amount on hand and the word *balance*, and bring the balance down on the opposite side in black ink, as above:

Cash Book.

190	Dr.			Cr.	
April 2.	To H. F. B.,	4000.00	April 5.	By Interest,	50.00
" 5.	" Note,	500.00	" 15.	" S. Conrad,	60.00
" 26.	" Sundries,	500.00	" 24.	" Expense,	90.00
			" 30.	" Balance, (*in red*)	4800.00
		5000.00			5000.00
April 30.	To balance,	4800.00			

As can be seen, the balance is obtained by adding the amount paid out, $200.00, and deducting from the total amount received, $5,000.00, the remainder being the amount on hand, $4,800.00.

A person doing a strictly cash business needs only one book, the cash book, and on its proper side all transactions are written. For instance, in Diagram I, his cash book shows, on the debtor side, a transaction of $100.00, and on the credit side $30.00; the difference is $70.00, the sum he should have on hand. In Diagram II the record of transactions appears complete, and no other book is required for the business.

Diagram I.

	Dr.			Cr.	
Jan. 2.	To Cash,	100.00	Feb. 4.	By Expense,	30.00
				" Balance,	70.00
		100.00			100.00

Diagram II.

CASH.

	Dr.			Cr.	
Jan. 1.	To Invest Account,	1000.00	Feb. 20.	By Repairs,	150.00
" 1.	" Cash,	2000.00		" Paper,	100.00
" 1.	" Sales,	500.00		" Labor,	500.00
" 1.	" Note,	500.00		" Expense,	50.00
				" Presses,	2,000.00
				" Equipment,	1,200.00
		4000.00			4000.00

Suppose, however, you are a merchant and your customers keep running accounts. You will then find it necessary to have a day book, cash book, and ledger. For example, a customer, Mr. J. G. Howard, comes in and asks for a statement of his account. Looking up the name in the index to the ledger, we find Mr. Howard on folio 78. Turning to his account we discover the following, as in Diagram III.

The debtor side, or what he owes you, is $285.50; the credit side, or what you owe him, or what has been paid, is $260.00, the difference being $25.50, this being in your favor and, therefore, is debit to you; if he pays the $28.50, enter it on creditor side of ledger, *By Cash 28.50*, debit your cash book, and then rule off the account with two parallel short lines in red as both sides of the account will then be the same.

Diagram III.

J. G. HOWARD.

1901	Dr.		1901	Cr.	
Jan. 1.	To Mdse.,	$200.00	Jan. 1.	By Cash,	$60.00
" 15.	" "	30.00	" 14.	" Note,	100.00
" 25.	" "	58.50	" 17.	" Cash,	50.00
			" 19.	" Note,	50.00
				" Balance,	28.50
		$288.50			$288.50
	To Balance,	$28.50			

A TRIAL LIST OF TRANSACTIONS

The following items will be found written up in the Day Book, Cash Book, Ledger, Bills Receivable and Bills Payable Books of succeeding pages. They should be carefully traced through the respective books and the reasons for their being so entered will be evident. Then the learner will do well to procure paper properly ruled and write up the transactions for himself. First reproduce by copying and afterward try to write up the whole set from the list given here; then compare and correct errors. In this way he will be able to master the subject.

190 .			
Jan. 1.	Began business with		$4,000
	Bought goods as follows of		
	E. J. White,		300.40
	Henry Short,		482.00
	Mrs. Pearl Cook,		600.00
	Ralph Wilson,		248.60
	Sold merchandise for cash,		29.60
Jan. 2.	Paid E. J. White,		160.00
	Paid Henry Short,		240.00
	Paid Mrs. Pearce Cook,		300.00
	Paid Ralph Wilson,		122.00
	Gave notes to		
	E. J. White, 2 mos.,		80.00
	Harry Short, 2 mos.,		180.00
	Mrs. Pearl Cook, 3 mos.,		120.00
	Ralph Wilson, 1 mo.,		80.00
	Bought merchandise of M. Young,		397.28
Jan. 3.	Sold to Jones & Co. merchandise as follows:		
	Paper,	48.00	
	Books,	52.80	
	Pads,	44.00	144.80
	Received Jones & Co. merchandise,		72.40
	3 mos. note,		72.40
	Sold A. Daniel, merchandise,		101.60
	Received from A. Daniel, cash,		40.00
	3 mos. note,		61.60
Jan. 5.	Sold to Bowers & Co., merchandise,		148.64
	Received from Bowers & Co., 2 mos. note,		148.64
	Paid M. Young, note paid to me by A. Daniel,	61.60	
	Also the 2 mos. note of Bowers & Co.,	148.64	210.24
	Bought of W. Henderson, merchandise,		240.00
	Sold him merchandise,		164.60
	Sold for cash, merchandise,		13.20
Jan. 6.	Paid wages,		8.44
	Paid expenses,		13.20
Feb. 5.	Paid note, Ralph Wilson,		80.00
Mar. 5.	Paid note, E. J. White,		80.00
	Paid note, Harry Short,		180.00
Apr. 5.	Paid note, Mrs. Pearl Cook,		120.00
	Received note of Jones & Co.,		72.40
Apr. 7.	A. Daniel's note returned by M. Young not honored,		61.60
Apr. 8.	Paid rent,		160.00
	Paid personal tax,		40.48
	Paid real estate tax,		30.40
May 1.	Sold merchandise to		
	Mackay & Co.,		40.00
	M. H. Smith,		36.48
	A. M. Jenks,		160.00
	E. Soley,		240.00
	F. M. Johnson,		148.40
Jun. 1.	Received the following notes at 3 mos.:		
	Mackay & Co.,		40.00
	M. H. Smith,		36.48
	A. M. Jenks,		160.00

January 1, 190–.

	Began business this day, investing $4,000 in cash					
10	*E. J. White, Bought of him as per invoice*	*Cr.*			300	40
12	*Harry Short, Bought of him as per invoice*	*Cr.*			482	00
13	*Mrs. Pearl Cook, Bought of her as per invoice*	*Cr.*			600	00
14	*Ralph Wilson, Bought of him as per invoice*	*Cr.*			248	60
15	*M. Young, Bought of him as per invoice*	*Cr.*			397	28
	3					
16	*Jones & Co.,*	*Dr.*			144	80
	Sold them the following goods, ½ cash balance on note at 3 months					
	Books		52	80		
	Paper $48.00 and Pads $44.00		92	00		
17	*A. Daniel, Sold him Mdse.*	*Dr.*			101	60
18	*Bowers & Co., Sold them Mdse.*	*Dr.*			148	64
15	*M. Young, Paid him notes*	*Dr.*				
	A. Daniel		61	60		
	Bowers & Co.		148	64	210	24
19	*W. Henderson, Bought of him Mdse.*	*Cr.*			240	00
19	*W. Henderson. Sold him Mdse.*	*Dr.*			164	60
20	*Mackey & Co., Sold them Mdse.*	*Dr.*			40	00
21	*M. H. Smith, Sold him Mdse.*	*Dr.*			36	48
22	*A. M. Jenks, Sold him Mdse.*	*Dr.*			160	00
23	*E. Solly, Sold him Mdse.*	*Dr.*			240	00
24	*F. M. Johnson, Sold him Mdse.*	*Dr.*			148	40
	June 20					
25	*Gerhart & Co., Bought of them Mdse.*	*Cr.*			104	40
26	*Woolson, Williams Co., Bought of them Mdse.*	*Cr.*			400	00
27	*George Page, Bought of him Mdse.*	*Cr.*			348	80
28	*D. Adams, Bought of him Mdse.*	*Cr.*			341	60

DAY BOOK—SINGLE ENTRY. Sometimes called *Journal*. Dr. and Cr. indicate the left and right side of Ledger to which the different items are posted from Day Book. Ledger Folio is at the left.

Dr. —*Cash*—

DATE	FOLIO IN LEDGER			
Jan. 1	×	*Capital, cash invested in the business*	4,000	00
Jan. 2	×	*Cash for sundry sales this day*	29	60
Jan. 3	17	*A. Daniel, payment on account*	40	00
Jan. 4	×	*Cash for sundry sales*	13	20
			4,082	80
Feb. 1	×	*To Balance*	3,239	16
March 1	×	*To Balance*	3,159	16
April 1	×	*To Balance*	2,899	16
	×	*Bills Receivable, No. 1*	72	40
			2,971	56
June 30		*Balance*	2,559	08

CASH BOOK—SINGLE ENTRY. All moneys received are entered on this page and posted to the Cr. column of Ledger and folio entered in column at left.

—Cash— Cr.

DATE	FOLIO IN LEDGER			
Jan. 2	10	*E. J. White*	160	00
	12	*Harry Short*	240	00
	13	*Mrs. Pearl Cook*	300	00
	14	*Ralph Wilson*	122	00
	×	*Expenses*	21	64
			843	64
		Balance [written in red]	3,239	16
			4,082	80
Feb. 5	×	*By Bills Payable, No. 4*	80	00
		Balance [written in red]	3,159	16
			3,239	16
March 5	×	*Bills Payable, No. 1*	80	00
		No. 2	180	00
			260	00
		Balance [written in red]	2,899	16
			3,159	16
April 5	×	*Bills Payable, No. 3*	120	00
April 7	17	*Protested Note, A. Daniel*	61	60
April 8	×	*Rent*	160	00
April 8	×	*Tax*	40	48
April 8	×	*Tax*	30	40
			412	48
		Balance [written in red]	2,559	08
			2,971	56

CASH BOOK—SINGLE ENTRY. All moneys paid out are entered on this page and posted to the Dr. side of Ledger and also entered in column at left. These pages should be written upon properly ruled paper like the script cash pages preceding.

Folio 10

Dr. *E. J. White* Cr.

Jan.	*2*	*Cash*	3	160	00	*Jan.*	*1*	*Day Book*	1	300	40
Jan.	*2*	*Bills Payable, No. 1*		80	00						
June	*30*	*Balance*		60	40						
				300	40					300	40
						June	*30*	*Balance*		60	40

Folio 13

Dr. *Harry Short* Cr.

Jan.	*2*	*Cash*	3	240	00	*Jan.*	*1*	*Day Book*	1	482	00
Jan.	*2*	*Bills Payable, No. 2*		180	00						
June	*30*	*Balance*		62	00						
				482	00					482	00
						June	*30*	*Balance*		62	00

Folio 13

Dr. *Mrs. Pearl Cook* Cr.

Jan.	*3*	*Cash*	3	300	00	*Jan.*	*1*	*Day Book*	1	600	00
Jan.	*2*	*Bills Payable, No. 3*		120	00						
June	*30*	*Balance*		180	00						
				600	00					600	00
						June	*30*	*Balance*		180	00

Folio 14

Dr. *Ralph Wilson* Cr.

Jan.	*2*	*Cash*	3	122	00	*Jan.*	*1*	*Day Book*	1	248	60
Jan.	*2*	*Bills Receivable, No. 4*		80	00						
June	*30*	*Balance*		46	60						
				248	60					248	60
						June	*30*	*Balance*		46	60

Folio 15

Dr. *M. Young* Cr.

Jan.	*5*	*Bills Receivable, No. 2 and 3*		210	24	*Jan.*	*1*	*Day book*	1	397	28
June	*30*	*Balance*		187	04						
				397	28					397	28
						June	*30*	*Balance*		187	04

Folio 16

Dr. *Jones & Co.* Cr.

Jan.	*3*	*Goods*		144	80	*Jan.*	*3*	*Cash*		72	40
								Bills receivable, No. 1		72	40
				144	80	*June*	*3*			144	80

LEDGER—SINGLE ENTRY

FOLIO 17

Dr. *A. Daniel* *Cr.*

Jan.	*3*	*Merchandise*	1	101	60	*Jan.*	*3*	*Cash*	2	40	00
				101	60	*June*	*3*	*Bills Receivable, No. 2*		61	60
										101	60
June	*30*	*Note Protested*	3	61	60						

FOLIO 18

Dr. *Bowers & Co.* *Cr.*

Jan.	*5*	*Merchandise*	1	148	64	*Jan.*	*5*	*Bills Receivable, No. 3*		148	64
				148	64					148	64

FOLIO 19

Dr. *W. Henderson* *Cr.*

Jan.	*5*	*To Merchandise*	1	164	60	*Jan.*	*5*	*Day Book*	1	240	00
June	*30*	*Balance*		75	40					240	00
				240	00	*June*	*30*	*Balance*		75	40

FOLIO 20

Dr. *Mackey & Co.* *Cr.*

Jan.	*3*	*Merchandise*	1	40	00	*June*	*1*	*Bills Receivable, No. 4*		40	00
				40	00					40	00

FOLIO 21

Dr. *M. H. Smith* *Cr.*

May	*1*	*Merchandise*	1	36	48	*June*	*1*	*Bills Receivable, No. 5*		36	48
				36	48					36	48

FOLIO 22

Dr. *A. M. Jenks* *Cr.*

May	*1*	*Merchandise*	1	160	00	*June*	*1*	*Note, Bills Receivable, No. 6*		160	00
				160	00					160	00

FOLIO 23

Dr. *E. Solly* *Cr.*

May	*1*	*Merchandise*	1	240	00	*June*	*1*	*Bills Receivable, No. 7*		240	00
				240	00					240	00

LEDGER—SINGLE ENTRY

Folio 24

Dr. ### *F. M. Johnson* *Cr.*

May	1	Merchandise	1	148	40	June	1	Bills Receivable, No. 8		148	40
				148	40					148	40

Folio 25

Dr. *Gerhart & Co.* *Cr.*

June	30	Bills Payable, No. 5		104	40	June	20	Goods as per Invoice	1	104	40
				104	40					104	40

Folio 26

Dr. *Woolson, Williams & Co.* *Cr.*

June	30	Bills Payable, No. 6		400	00	June	20	By Goods	1	400	00
				400	00					400	00

Folio 27

Dr. *George Page* *Cr.*

June	30	Bills Payable, No. 7		348	80	June	20	By Goods, per Day Book	1	348	80
				348	80					348	80

Folio 28

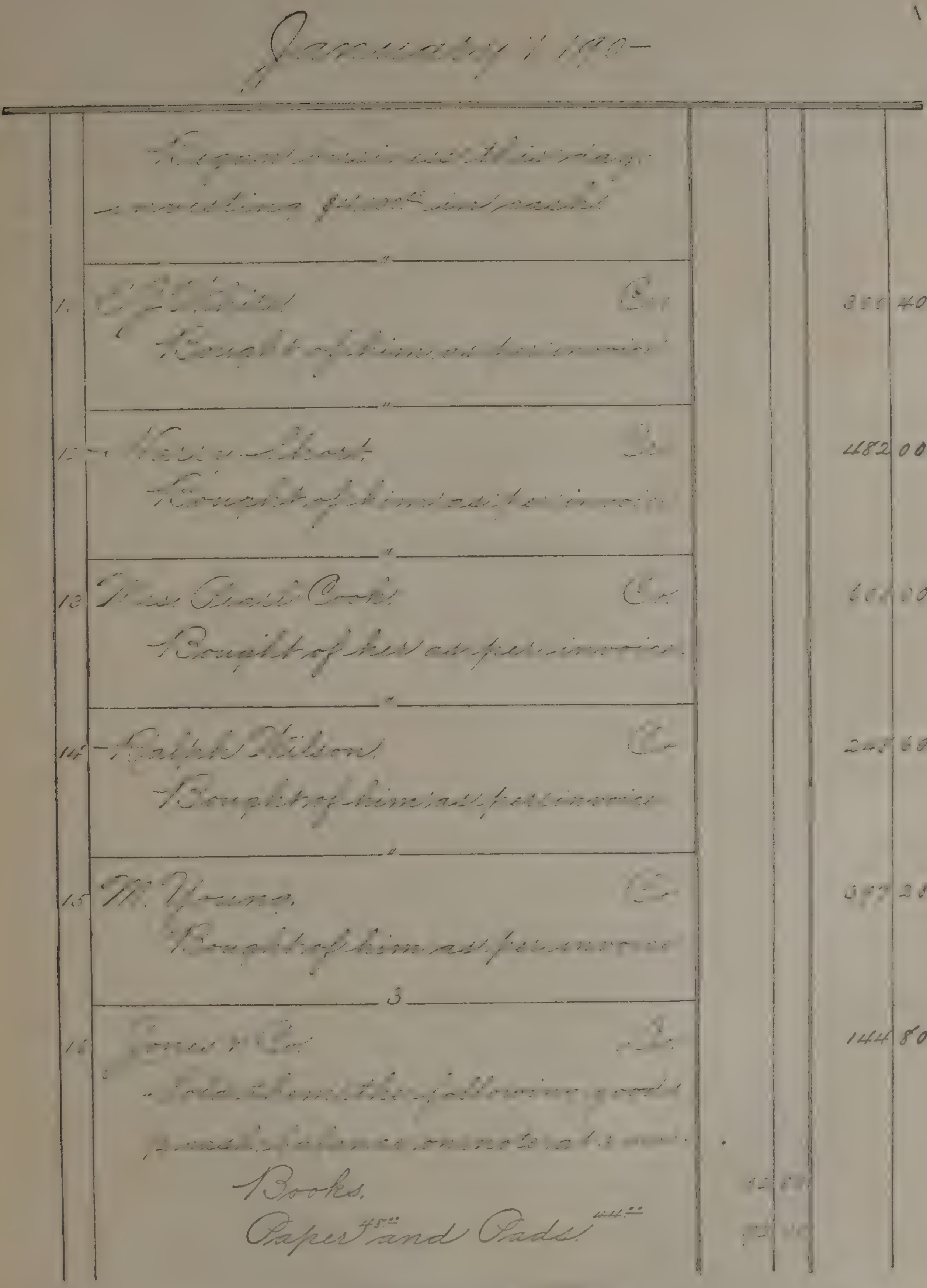
Dr. *D. Adams* *Cr.*

June	30	Bills Payable, No. 8		341	60	June	20	By Goods	1	341	60
				341	60					341	60

June 30, 19 —Balance Sheet—

Dr. *Cr.*

FOLIO IN LEDGER		BALANCE AS PER LEDGER		FOLIO IN LEDGER		BALANCE AS PER LEDGER	
	Cash on Hand	2,559	08	10	E. J. White	60	40
	Notes Due	624	88	12	Harry Short	62	00
	Protested Note	61	60	13	Mrs. Pearl Cook	180	00
	Stock Estimated at			14	Ralph Wilson	46	60
	by Inventory	2,308	16	15	M. Young	187	04
				19	W. Henderson	75	40
					Notes Payable	1,194	80
						1,806	24
					Balance	3,747	48
		5,553	72			5,553	72
	June 30, Balance	3,747	48				



January 1 190–

[illegible]

1. [illegible] Cr. 3[illegible] 40

Bought of him as per invoice

12 [illegible] Cr. 482 00

Bought of him as per invoice

13 Miss Pearl Cook Cr. 6[illegible] 00

Bought of her as per invoice

14 Ralph Wilson Cr. 24[illegible] 60

Bought of him as per invoice

15 M. Young Cr. 3[illegible] 28

Bought of him as per invoice

3

16 Jones & Co. Dr. 144 80

Sold them the following goods [illegible]

[illegible]

Books

Paper 48.00 and Pads 144.00

PRACTICAL BOOKKEEPING

This page and others of the series have been prepared for this work by an expert accountant and by Professor R. S. Collins, the Eminent Business College Instructor and Penman. The simplest and most approved forms used in Bookkeeping are shown. Full instructions are given in the text

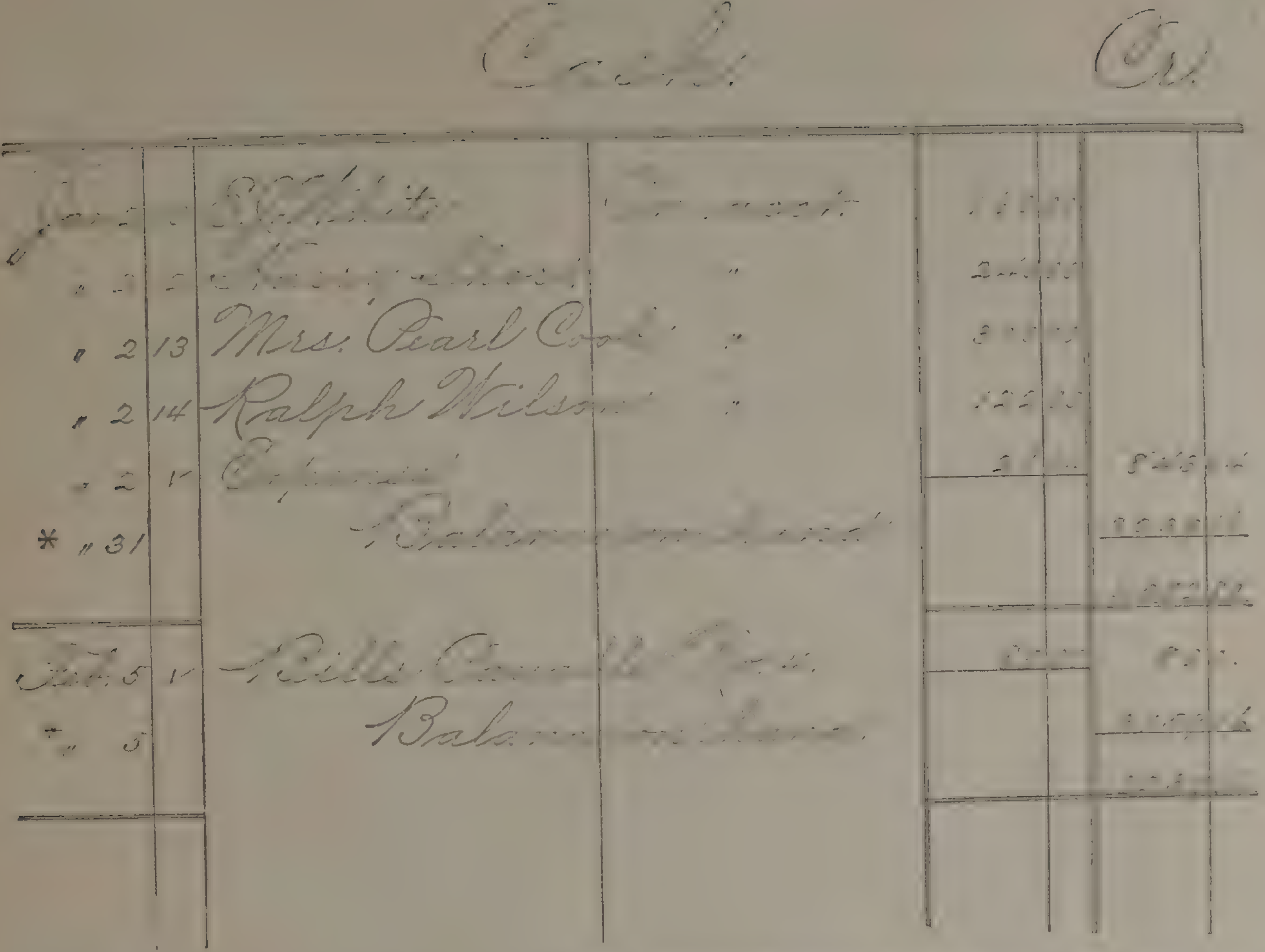
Dr. Cash.

Jan. 1	1	Your name	Investment.	4000	00		
" 2	✓	Mdse.	Cash sales	29	60		
" 3	17	A. Daniel.	On acct.	40	00		
" 4	1	Mdse.	Cash sales.	13	20	4082	80
						4082	80
Feb. 1		Balance on hand.				3239	16
						3239	16
Feb. 5		Balance on hand.				3159	16

Single Entry.—Explanations.

The Journal.—On p. 259 all items of the trial list that belong to the Journal will be found in their proper places. Page A is prepared to show you how these will appear when neatly written in the Journal. As the $4,000.00 item does not appear in the Ledger account, but does appear in the cash, it is not carried out to the dollars' and cents' column. You will note that in the Journal in the open unruled space at the top is the date of opening the business. Each succeeding date of that month, as 3, 5, 7, and so on, is written down the centre of the page at the opening of that day's transactions. Each transaction has below it a line in black, broken in the centre with two dots. At the left in a column is the folio in the Ledger to which that item is carried. Cr. and Dr. indicate on which side of the account in the Ledger the item is posted. The account is *credited with what is received from it, and debited with what is sold to it*, as will be seen. Where two or more items are specified, the amount of each item appears in the first column for dollars and cents, and the total amount is carried to the second column.

The Cash Book.—On pp. B and C is shown how the two sides of the Cash Book should be written, the debit side being on the left and the credit side on the right, facing each other. On pages 260, 261, single entry cash for this is shown complete. Enough should be told in entering each account to explain the transaction. It will be noticed that there are rulings at the left for the date and Ledger folio, and the right two columns for dollars and cents, the second of which is used in balancing the account at the end of the month, or at any given period. The line down the centre of the page of the Cash Book is usually a pale blue line for convenience of the bookkeeper in arranging his explanation to the right of it. It is not a necessary line. At the end of each month it is well to balance the Cash Book, and begin the next month by bringing down the balance on hand. The debit side of the cash account represents the money received, the credit side the money paid out. The debit side should always exceed the credit side in the cash account. *Balance on Hand*, marked with a star, is usually written in red ink, as also is the double line drawn beneath. You should also note where the single and double horizontal lines begin and end.



Cash Cr.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
"	2	[illegible]	[illegible]	"	[illegible]	
"	2	13	Mrs. Pearl Cook	"	[illegible]	
"	2	14	Ralph Wilson	"	[illegible]	
"	2	1	Expense		[illegible]	[illegible]
* "	31		Balance on hand			[illegible]
						[illegible]
Feb.	5	1	Bills [illegible]		[illegible]	[illegible]
* "	5		Bala[illegible]			[illegible]
						[illegible]

The Ledger.—As the story of each transaction is told in the Cash Book, Day Book, or Bills Receivable Book, the Ledger does not furnish a history of each transaction; therefore less space will be required, and both sides of the account, the debit and credit, may be kept on one page, while in the Cash Book two pages are required for the accounts. The rulings for the Ledger, as you will observe, are entirely different from those of the preceding books. Spaces are provided for the date, for the folio of the Cash Book or Day Book, and for dollars and cents. Every item found in the Ledger should have a reference back to another book, where explanation can be found of the transaction.

How Accounts are arranged in the Ledger. While you may give one full page of the Ledger to each account, it will often be found more convenient to arrange two, or even three accounts on a page. The first, of course, will be at the top, and the second one, half way down. The name of the account is always written in large script in the centre of the page, from left to right, with Dr. and Cr. at the left and right respectively. The year may be written either immediately below or above the top line. If any one account is an important one, which is likely to be used freely, and which may contain many items, it will be best to allow it a full page. When all the space on any given page is filled, the account is transferred to another page by closing it with the words, "To" or "By Balance carried to Folio (—)" and beginning the transferred account on the new page with the words, "By," or "To Balance from Folio (—)." On page D are shown three accounts written up as they would appear in the Ledger, on three different folios, namely, 10, 12 and 13. Taking the first account, E. J. White, the first item of $160.00 is brought from the Cash Book and indicated by "1" in the folio column. The second item on the debit side, $80.00, is from the Bills Payable Book, and on the credit side item $300.40 brought from the Day Book, as indicated by the folio "1." As the credit side exceeds the debit side by $60.40, we write on the debit side in red ink, "June 30, Balance $60.40," beneath which we draw one horizontal line on each side, in red, bring down the total $300.40 beneath, draw double red line, and the account is closed for the half year. The balance of $60.40 is brought down under the credit side, indicating that we are in debt to E. J. White to that amount. It may be observed that in writing up this set of accounts the beginner should follow particularly the style indicated by the *script* pages of Journal, Cash and Ledger.

D

Folio 10.

Dr. E. J. White. Cr.

190-					190-				
Jan.	2	Cash	1	160 00	Jan.	1	Day Book	1	300 00
"	2	Bills Pay.	1	80 00					
*June	30	Balance		60 00					
				300 00					300 00
					June	30	Balance		60 00

Folio 12.

Dr. Harry Short. Cr.

190-					190-				
Jan.	2	Cash	2	240 00	Jan.	1	Day Book		482 00
"	2	Bills Pay.	2	180 00					
*June	30	Balance		62 00					
				482 00					482 00
					June	30	Balance		62 00

Folio 13.

Dr. Mrs. Pearl Cook. Cr.

190-					190-				
Jan.	2	Cash	3	300 00	Jan.	1	Day Book	1	600 00
"	2	Bills Pay.	3	120 00					
*June	30	Balance		180 00					
				600 00					600 00
					June	30	Balance		180 00

LEDGER—SINGLE ENTRY. This page should be studied and copied as it is a model for penmanship, arrangement and ruling. * Line is written in *red.*

—*Bills Receivable*—

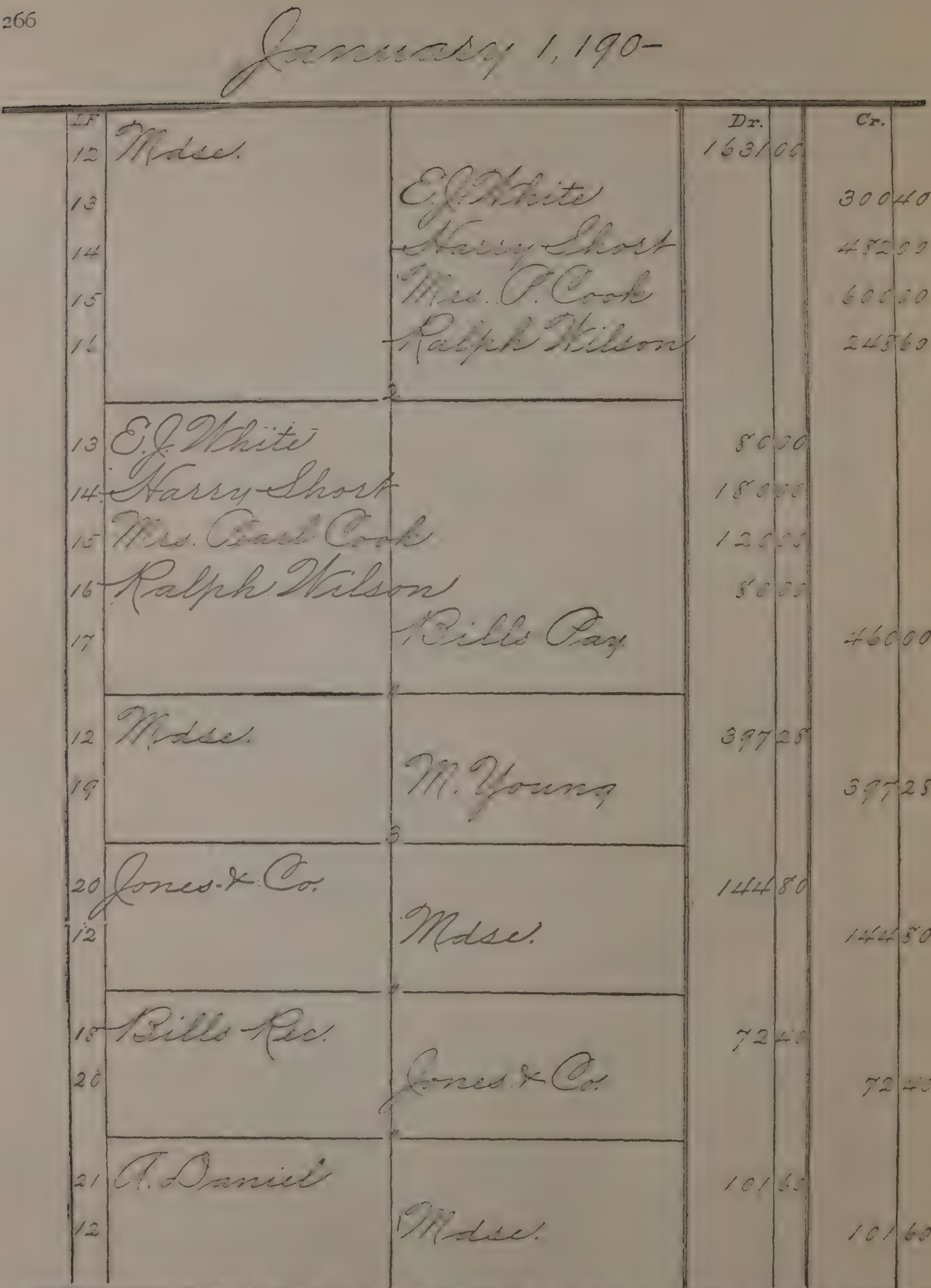
FOLIO	NUMBER OF BILL	ON WHOSE ACCOUNT	DATE	TIME	DUE	AMOUNT
16	1	*Jones & Co.*	*Jan. 3*	*3 mos.*	*April 6*	72.40
17	2	*A. Daniel*	*Jan. 5*	*2 mos.*	*March 8*	61.60
18	3	*Bowers & Co.*	*Jan. 5*	*2 mos.*	*March 8*	148.64
						282.64
20	4	*Mackey & Co.*	*June 1*	*3 mos.*	*Sept. 4*	40.00
21	5	*M. H. Smith*	*June 1*	*3 mos.*	*Sept. 4*	36.48
22	6	*A. M. Jenks*	*June 1*	*3 mos.*	*Sept. 4*	160.00
23	7	*E. Solly*	*June 1*	*3 mos.*	*Sept. 4*	240.00
24	8	*F. M. Johnson*	*June 1*	*3 mos.*	*Sept. 4*	148.40
						624.88

—*Bills Payable*—

FOLIO	NUMBER OF BILL	BY WHOM DRAWN	DATE	TIME	DUE	AMOUNT
10	1	*E. J. White*	*Jan. 2*	*2 mos.*	*Mar. 5*	80.00
12	2	*Harry Short*	*Jan. 2*	*2 mos.*	*Mar. 5*	180.00
13	3	*Mrs. Pearl Cook*	*Jan. 2*	*3 mos.*	*April 5*	120.00
14	4	*Ralph Wilson*	*Jan. 2*	*1 mo.*	*Feb. 5*	80.00
						460.00
25	5	*Gerhart & Co.*	*June 30*	*3 mos.*	*Sept. 2*	104.40
26	6	*Woolson, Williams & Co.*	*June 30*	*3 mos.*	*Sept. 2*	400.00
27	7	*George Page*	*June 30*	*3 mos.*	*Sept. 2*	348.80
28	8	*D. Adams*	*June 30*	*3 mos.*	*Sept. 2*	341.60
						1,194.80

BILL BOOK. The above are two pages of a separate book known as the BILL BOOK. In this, under *Bills Receivable* are entered in regular order, the notes and paper which the owner receives in the course of business.

Under *Bills Payable* are entered in regular order the record of the notes given to others or any paper issued. Each note is entered with its number, the dates when it was drawn, when due, with time it has to run and the amount of its face, together with name of parties signing who are known as the maker or makers of the notes. The folio at the left indicates where the account is found in the Ledger; each item in this book must appear in the Ledger. Bills Receivable appear on the Cr. side of Ledger and Bills Payable on Dr. side. The BILL BOOK is an important one to the business man and he should be careful in making his entries. He should refer to it daily to see what paper he has to pay and arrange therefor, also to see what paper becomes due and see that it is presented for payment at proper time and place. He must remember that if a note is made payable in a bank it must be there before the appointed time so that, if not paid by the maker, the endorser may be notified and held by a protest. If such notice be not given by proper officer the endorser cannot be held. On the other hand, if you overlook time of payment for your own notes (Bills Payable) and it goes to protest it causes annoyance and, if repeated, injuries your credit.



January 1, 190–

L.F.			Dr.		Cr.	
12	Mdse.		1631	00		
13		E. J. White			300	40
14		Harry Short			482	00
15		Mrs. P. Cook			600	00
16		Ralph Wilson			245	60
	2					
13	E. J. White		80	00		
14	Harry Short		180	00		
15	Mrs. Pearl Cook		120	00		
16	Ralph Wilson		80	00		
17		Bills Pay.			460	00
12	Mdse.		397	25		
19		M. Young			397	25
	3					
20	Jones & Co.		144	80		
12		Mdse.			144	50
18	Bills Rec.		72	40		
20		Jones & Co.			72	40
21	A. Daniel		101	60		
12		Mdse.			101	60

JOURNAL—DOUBLE ENTRY. This page should be studied and copied as it is a model for penmanship, arrangement and ruling. All horizontal lines are in black. Central vertical line is a faint blue one.

Folio 12.

Dr. Merchandise. Cr.

190-					190-				
Jan.	1	To Sundries	1	1631 20	Jan.	1	By Cash	1	29 60
"	2	" M. Young	1	397 28	"	3	" Jones & Co.	1	144 80
"	3	" Jones & Co.	1	72 00	"	3	" A. Daniel	1	101 60
"	5	" H. Henderson	2	240 50	"	5	" Powers & Co.	2	148 64
June	30	" Sundries	2	1194 50	"	5	" H. Henderson	2	164 60
					"	5	" Cash	2	13 20
					May	1	" Bills Rec.	3	624 88
					*June	30	" Balance		2308 16
				3535 48					3535 48
July	1	To Balance		2308 16					

Folio 17.

Dr. Bills Payable. Cr.

190-					190-				
Jan.	5	To Cash	1	80 00	Jan.	1	By Sundries	1	460 00
"	5	" "	1	80 00	April	1	" "	3	1194 80
"	5	" "	1	180 00					
"	5	" "	1	120 00					
*June	30	" Balance		1194 80					
				1654 80					1654 80
					July	1	By Balance		1194 80

LEDGER—DOUBLE ENTRY. This page should be studied and copied as it is a model for penmanship, arrangement and ruling. All horizontally and diagonally ruled lines are in *red*

Dr. —*Cash*—

DATE	FOLIO IN LEDGER			
Jan. 1	11	*Capital, cash invested in the business*	4,000	00
Jan. 2	12	*Cash for sundry sales this day*	29	60
Jan. 3	21	*A. Daniel, payment on account*	40	00
Jan. 4	12	*Cash for sundry sales*	13	20
			4,082	80
Jan. 1	×	*To Balance*	3,239	16
March 1	×	*To Balance*	3,159	16
April 1	×	*To Balance*	2,899	16
	18	*Bills Receivable, No. 1*	72	40
			2,971	56
June 30		*Balance*	2,559	08

CASH BOOK—DOUBLE ENTRY. All moneys received are entered on this page and posted to the Cr. column of Ledger and folio entered in column at left.

—Cash— Cr.

DATE	FOLIO IN LEDGER			
Jan. 2	13	*E. J. White*	160	00
	14	*Harry Short*	240	00
	15	*Mrs. Pearl Cook*	300	00
	16	*Ralph Wilson*	122	00
	33	*Expenses*	21	64
			843	64
		Balance [written in red]	3,239	16
			4,082	80
Jan. 5	17	*By Bills Payable, No. 4*	80	00
		Balance [written in red]	3,159	16
			3,239	16
March 5	17	*Bills Payable, No. 1*	80	00
	17	*No. 2*	180	00
			260	00
		Balance [written in red]	2,899	16
			3,159	16
April 5	17	*Bills Payable, No. 3*	120	00
April 7	21	*Protested Note, A. Daniel*	61	60
April 8	×	*Rent*	160	00
April 8	×	*Tax*	40	48
April 8	×	*Tax*	30	40
			412	48
		Balance [written in red]	2,559	08
			2,971	56

CASH BOOK—DOUBLE ENTRY. All moneys paid out are entered on this page and posted to the Dr. side of Ledger and folio entered in column at left. These pages should be written up on properly ruled paper like the script cash pages.

January 1, 190–.

L. F.			Dr.		Cr.	
12	*Merchandise*		1631	00		
13		*E. J. White*			300	40
14		*Harry Short*			482	00
15		*Mrs. Pearl Cook*			600	00
16		*Ralph Wilson*			248	60
	2					
13	*E. J. White*		80	00		
14	*Harry Short*		180	00		
15	*Mrs. Pearl Cook*		120	00		
16	*Ralph Wilson*		80	00		
17		*Bills Payable*			460	00
	//					
12	*Merchandise*		397	28		
19		*M. Young*			397	28
	3					
20	*Jones & Co.*		144	80		
12		*Merchandise*			144	80
	//					
12	*Merchandise*		72	40		
20		*Jones & Co.*			72	40
	//					
18	*Bills Receivable*		72	40		
20		*Jones & Co.*			72	40
	//					
21	*A. Daniel*		101	60		
12		*Merchandise.*			101	60
	//					
18	*Bills Receivable*		61	60		
21		*A. Daniel*			61	60
	5					
22	*Bowers & Co.*		148	64		
12		*Merchandise*			148	64
	//					
19	*M. Young*		210	24		
18		*Bills Receivable*			210	24
	//					
12	*Merchandise*		240	00		
23		*W. Henderson*			240	00

THE JOURNAL—DOUBLE ENTRY

January 5, 190–

L. F.			Dr.		Cr.	
18	*Bills Receivable*		148	64		
32		*Bowers & Co.*			148	64
		5				
23	*W. Henderson*		164	60		
12		*Merchandise*			164	60
		May 1				
24	*Mackey & Co.*		40	00		
25	*M. H. Smith*		36	48		
26	*A. M. Jenks*		160	00		
27	*E. Solly*		240	00		
28	*F. M. Johnson.*		148	40		
12		*Merchandise*			624	88
		June 1				
18	*Bills Receivable*		624	88		
24		*Mackey & Co.*			40	00
25		*M. H. Smith*			36	48
26		*A. M. Jenks*			160	00
27		*E. Solly*			240	00
28		*F. M. Johnson*			148	40
		20				
12	*Merchandise*		1194	80		
24		*Gerhart & Co.*			104	40
30		*Woolson, Williams & Co.*			400	00
31		*George Page*			348	80
32		*D. Adams*			341	60
		30				
24	*Gerhart & Co.*		104	40		
30	*Woolson, Williams & Co.*		400	00		
31	*George Page*		348	80		
32	*D. Adams*		341	60		
17		*Bills Payable*			1194	80
		11				
34	*Loss and Gain*		252	52		
33		*Expenses Account*			252	52

THE JOURNAL—DOUBLE ENTRY. **Each item must be entered twice in the Ledger. Hence the name** ***double entry.*** The Journal provides for this by a double column for dollars and cents, one representing the *Dr.* and the other *Cr.* entry in the Ledger. The folio numbers of the Ledger are entered at the left. The first date is at top of the page and each succeeding date follows in its place in centre of page. Each entry in Journal is followed by a broken ruled line. The vertical ruled line serves to divide the *Dr.* from *Cr.* items. Where several items are charged to one account the sum total only is placed against said item, as in first entry. **Footings in lead pencil should be made of each dollars' and cents' column of Journal page to test accuracy, as these totals must agree.**

Folio 10

Cash

Dr. *Cr.*

Jan.	*2*	*To Capital Account*	1	4000	00	*June*	*30*	*By Disbursements*		1596	12
Jan.	*2*	*" Hand*		155	20			*" Balance*		2559	08
				4155	20					4155	20
June	*30*	*To Balance*		2559	08						

Folio 11

Capital Account

Dr. *Cr.*

						Jan.	*1*	*By Cash*		4000	00

Folio 12

Merchandise

Dr. *Cr.*

Jan.	*1*	*To Sundries*	1	1631	00	*Jan.*	*1*	*By Cash*	1	29	60
"	*2*	" "	1	397	28	"	*3*	*" Jones & Co.*	1	144	80
"	*3*	" "	1	72	40	"	*3*	*" A. Daniel*	1	101	60
"	*5*	" "	1	240	00	"	*5*	*" Bowers & Co.*	1	148	64
June	*20*	" "	2	1194	80	"	*5*	*" W. Henderson*	2	164	60
						June	*5*	*" Cash*	1	13	20
						May	*1*	*" Sundries*	2	624	88
						June	*30*	*" Balance*		2308	16
				3535	48					3535	48
June	*30*	*To Balance*		2308	16						

Folio 13

E. J. White

Dr. *Cr.*

Jan.	*2*	*To Bills Payable*	2	80	00	*Jan.*	*1*	*By Merchandise*	1	300	40
Jan.	*2*	*" Cash*	2	160	00						
June		*" Balance*		60	40						
				300	40					300	40
						June	*30*	*By Balance*		60	40

Folio 14

Harry Short

Dr. *Cr.*

Jan.	*2*	*To Bills Payable*	1	180	00	*Jan.*	*1*	*By Merchandise*	1	482	00
Jan.	*2*	*To Cash*	2	240	00						
June		*To Balance*		62	00						
				482	00					482	00
						June	*30*	*By Balance*		62	00

LEDGER—DOUBLE ENTRY

Folio 15

Dr. Mrs. Pearl Cook *Cr.*

Jan.	*2*	*To Bills Payable*	1	120	00	*Jan.*	*1*	*By Merchandise*	1	600	00
Jan.	*2*	*" Cash*	2	300	00						
June		*" Balance*		180	00						
				600	00					600	00
						June	*30*	*By Balance*		180	00

Folio 16

Dr. Ralph Wilson *Cr.*

Jan.	*2*	*To Bills Payable*	1	80	00	*Jan.*	*1*	*By Merchandise*	1	248	60
Jan.	*2*	*" Cash*	2	122	00						
June		*" Balance*		46	60						
				248	60					248	60
						June	*30*	*By Balance*		46	60

Folio 17

Dr. Bills Payable *Cr.*

Jan.	*5*	*To Cash*	2	80	00	*Jan.*	*2*	*By Sundries*	1	460	00
Mar.	*5*	*" "*	2	80	00	*June*	*30*	*" Sundries*	2	1194	80
April	*5*	*" "*	2	180	00						
"	*5*	*" "*	2	120	00						
		" Balance		1194	80						
				1654	80					1654	80
						June	*30*	*By Balance*		1194	80

Folio 18

Dr. Bills Receivable *Cr.*

Jan.	*3*	*To Jones & Co.*	1	72	40	*Jan.*	*1*	*By M. Young*	1	210	24
"	*3*	*" Cash*	2	61	60	*April*	*1*	*" Cash*	1	72	40
"	*5*	*" Bowers & Co.*	2	148	64	*June*	*30*	*" Balance*		624	88
June	*1*	*" Sundries*	2	624	88						
				907	52					907	52
June	*30*	*To Balance*		624	88						

Folio 19

Dr. M. Young *Cr.*

Jan.	*5*	*To Bills Receivable*	1	210	24	*Jan.*	*1*	*By Merchandise*	1	397	28
		" Balance		187	04						
June	*30*			397	28					397	28
						June	*30*	*By Balance*		187	04

LEDGER—DOUBLE ENTRY

Folio 20

Dr. ### *Jones & Co.* *Cr.*

Jan.	*3*	*To Merchandise*	1	144	80	*Jan.*	*3*	*By Bills Receivable*	1	72	40
								" Cash	1	72	40
				144	80	*Jan.*	*3*			144	80

Folio 21

Dr. ### *A. Daniel* *Cr.*

Jan.	*3*	*To Merchandise*	1	101	60	*Jan.*	*3*	*By Bills Receivable*	1	61	60
April	*7*	*" Protested Note*	2	61	60	*June*	*3*	*" Cash*	1	40	00
June	*30*							*" Balance*	1	61	60
				163	20					163	20
		To Balance		61	60						

Folio 22

Dr. ### *Bowers & Co.* *Cr.*

Jan.	*5*	*To Merchandise*	1	148	64	*Jan.*	*5*	*By Bills Receivable*	2	148	64
				148	64					148	64

Folio 23

Dr. ### *W. Henderson* *Cr.*

Jan.	*5*	*To Merchandise*	2	164	60	*Jan.*	*5*	*By Merchandise*	1	240	00
June	*30*	*" Balance*		75	40						
				240	00					240	00
						June	*30*	*By Balance*		75	40

Folio 24

Dr. ### *Mackey & Co.* *Cr.*

May	*1*	*To Merchandise*	2	40	00	*June*	*1*	*By Bills Receivable*	2	40	00
				40	00					40	00

Folio 25

Dr. ### *M. H. Smith* *Cr.*

May	*1*	*To Merchandise*	2	36	48	*June*	*1*	*By Bills Receivable*		36	48
				36	48					36	48

LEDGER—DOUBLE ENTRY

Folio 26

Dr. *A. M. Jenks* *Cr.*

May	*1*	*To Merchandise*	2	160	00	*June*	*1*	*By Bills Receivable*	2	160	00
				160	00					160	00

Folio 27

Dr. *E. Solly* *Cr.*

May	*1*	*To Merchandise*	2	240	00	*June*	*1*	*By Bills Receivable*	2	240	00
				240	00					240	00

Folio 28

Dr. *F. M. Johnson* *Cr.*

May	*1*	*To Merchandise*	2	148	40	*June*	*1*	*By Bills Receivable*	2	148	40
				148	40					148	40

Folio 29

Dr. *Gerhart & Co.* *Cr.*

June	*30*	*To Bills Payable*	2	104	40	*June*	*20*	*By Merchandise*	2	104	40
				104	40					104	40

Folio 30

Dr. *Woolson, Williams & Co.* *Cr.*

June	*30*	*To Bills Payable*	2	400	00	*June*	*20*	*By Merchandise*	2	400	00
				400	00					400	00

Folio 31

Dr. *George Page* *Cr.*

June	*30*	*To Bills Payable*	2	348	80	*June*	*20*	*By Merchandise*	2	348	80
				348	80					348	80

Folio 32

Dr. *D. Adams* *Cr.*

June	*30*	*To Bills Payable*	2	341	60	*June*	*20*	*By Merchandise*	2	341	60
				341	60					341	60

LEDGER—DOUBLE ENTRY

Folio 33

Dr. *General Expense* Cr.

Jan.	*6*	*To Cash*		21	64	*June*	*30*	*By Sundries*		252	52
April	*8*	" "		160	00						
"	*8*	" "		40	48						
"	*8*	" "		30	40						
				252	52					252	52

Folio 34

Dr. *Loss and Gain* Cr.

June	*30*	*To Sundries*		252	52			*By Balance*		252	52
		Balance		252	52						

LEDGER—DOUBLE ENTRY

June 30, 19 *—Balance Sheet—*

Dr. Cr.

FOLIO IN LEDGER		BALANCE AS PER LEDGER		FOLIO IN LEDGER		BALANCE AS PER LEDGER	
10	*Cash on Hand*	2,559	08	11	*Capital*	4,000	00
12	*Merchandise*	2,308	16	13	*E. J. White*	60	40
18	*Bills Receivable*	624	88	14	*Harry Short*	62	00
21	*A. Daniel*	61	60	15	*Mrs. Pearl Cook*	180	00
34	*Loss and Gain*	252	52	16	*Ralph Wilson*	46	60
				18	*Bills Payable*	1,194	80
				19	*M. Young*	187	04
				23	*W. Henderson*	75	40
		5,806	24			5,806	24

Explanation—Double-Entry Bookkeeping.

In the single-entry bookkeeping, it will be remembered, there is only one record, whereas in double-entry each item appears twice, once as *debit* and again as *credit*; also in the former, cash, stocks, goods, etc., did not appear as individual accounts, whereas in double-entry each of these is made an individual account. As it takes two parties to make a transaction, so in the *Ledger* it requires two entries, one for each party, to be made; for example, the *Journal* shows that *Merchandise* is debtor to four items, $1631.00. Turning to the *Ledger*, folio 12, we will find $1631.00 entered on the debtor side of the *Merchandise* account, and in folios 13-14-15 and 16, we shall find the four items entered under their respective accounts, which together exactly balance the $1631.00; or, if the transaction be a cash transaction, and cash is paid out, as in the *Cash Book* on the credit side the item "E. J. White, $160.00," this item appears on the debtor side of one account, folio 13, and on the credit side of *Cash* account, folio 10, under the sum total of "Disbursements." These two examples suffice to show how in double-entry bookkeeping every item must appear twice in the *Ledger*, once on the debtor side and once on the credit side; consequently, if every entry is made properly and accurately, the sum total of the entries on the debtor side of the *Ledger* must equal the sum total of the entries on the credit side of the *Ledger*. The student should first carefully trace every item of the *Journal* and *Cash Book* to its proper place in the *Ledger*, afterwards write up a set of books for himself, copying, on properly ruled paper, the set as printed in this book, using the rulings indicated by the model script pages for each book, where the ruling has been accurately made. Afterwards, turning back, endeavor to write up the trial list of transactions into a set of double-entry accounts.

Journal.—We have reproduced a model page of the *Journal* which differs from the single-entry only in slight particulars. It is more properly a *Journal* than a *Day Book*, as it is used to indicate by the entries which side of the *Ledger* each item is to be posted, whereas the *Day Book* is a mere history of the daily transactions, without arranging the items with reference to their being posted to the *Ledger*. In journalizing the bookkeeper should have clearly in his mind which is the debit and which is the credit item, beginning his entry always and uniformly with the debit item; for instance, "Merchandise, Debtor to E. J. White." The word "debtor" is not expressed in the *Journal*, the debit item being to the left and the credit item to the right. Debit amount in the first column and credit amount in the second column.

Cash Book.—The *Cash Book* in double-entry is in all particulars the same in form as that of single-entry. (Compare the script pages.) It is to be remembered that the item entered in Cash on the debtor side appears on the credit side of the *Ledger* account to that particular item, and the second entry will be accounted for in the *Cash Account* of the *Ledger*. It is important in receiving cash to enter it at the time received in the *Cash Book*, on the debtor side, and under the name of the account to which it is to be posted in the *Ledger;* for instance, A. Daniel pays his account, $40.00. The cash entry is "A. Daniel, Payment on Account $40.00." It is customary in business to classify the receipts under one or two general accounts, and open in the *Ledger* only such accounts as are desired to keep a record of; hence such entries as "Cash for Sundry Sales" indicate that these will be accounted for in the *Ledger* in the *Cash Account*. Where there are two or three sources from which moneys are received, which are necessary to be posted, the *Cash* contains a separate dollar and cents ruling at the right for each; hence some Cash Books have as many as four or five rulings for dollars and cents, and at the top of each ruling is indicated the name of the account, as *Rents*, *Hardware*, *Groceries*, *etc*. And on the credit side the money paid out may be for such accounts as *Postage*, *Taxes*, *Freights*. At the end of each month these columns should be added and the totals posted to their respective accounts in the *Ledger*. This is a very convenient form, and easily understood.

Red ink should be sparingly used in bookkeeping, and when used it should be uniformly done. It is customary in the *Cash Book* to rule all horizontal lines in red, and on the credit side the word "Balance" and the amount opposite to it are written in red, but brought down on the debit side in black. Note the ruling in the *Cash Book*, in the model pages. It will be seen that the single horizontal line extends only across one column, the double horizontal line across two columns.

Ledger.—What has been said in the single-entry as to the arrangement of the accounts on the pages of the *Ledger* applies also to the double entry. The ruling also is, in the main, the same in both. It will be remembered that in the double-entry bookkeeping we have such accounts as *Cash*, *Capital Account*, *Merchandise*, *Bills Payable*, *and Bills Receivable*, which did not appear in the single-entry. The *Cash* account, folio 10, is debtor to the *Capital* account $4,000.00, and the *Capital* account is credited "By Cash $4,000.00." The *Cash* account is credited "By Disbursements" as indicated on the credit side of the *Cash Book*. It is debited again by the amount of cash on hand at the time of closing the books, giving a balance of $2,559.08, which is entered on the credit side, which closes the account, and appears again on the debit side when the account is again opened. *Merchandise*, folio 12, is debited "To Sundries," which means that there are several items, the total of which is $1631.00, or whatever the amount is written opposite the word, and it is credited "By" several individual accounts, the folio number being entered in the column prepared for that purpose. Each of these items should be accounted for in some one of the other accounts.

In *Bills Payable* account on the debit side are posted the amounts of notes paid out and which are our obligations to pay. When paid each is entered on the debit side of Cash as Bills Payable and posted to credit side of Bills Payable account, thus balancing each note. The face amounts of the notes must always be posted in full on either side of the Bills Payable account, and any discount or interest will be charged or credited as the case may be to Interest and Discount Accounts.

Closing Books.—In closing the books at any given period we rule off all personal accounts and bring the balance down in red ink; if our debtor, the account will appear first on the credit side in red ink "*By Balance*" then transfer to the debit side "*To Balance*"; if our creditor, the reverse of the above operation. In closing loss and gain accounts and personal accounts uncollected (which become Loss and Gain accounts) we charge them to Loss and Gain account. But it should be understood that personal accounts are not in fact Loss and Gain accounts, as they could be charged to Merchandise account with the same result, as the profit from the sale of our goods would be lessened to the extent of our bad accounts, as "To Jones & Co. $72.40" is a note received from them, posted from the *Journal;* on the credit side "April 1, By Cash $72.40" is posted through *Cash* when the note was paid. Whenever notes are taken the parties giving them must be *credited* and the *Bills Receivable debited.* When notes are given the parties receiving them must be *debited* and the *Bills Payable credited.* When cash is paid out *Cash* must be *credited* and whatever is paid out must be *debited*.

In *Loss and Gain* account the credit side shows when there is a gain in business, and the debit side shows when there is a loss in business. The *Loss and Gain* account is the account where all bad debts must be charged by transferring them from the individual accounts, through the *Journal*, into the *Loss and Gain* account.

In order to see that our entries and postings have been right, the following method must be followed, which is called "balancing the books:"

Balancing Books.—Balance each individual account, strike a balance, which is done by entering the difference of the two sides of the account on the side requiring an addition to make it equal to the other side, draw two horizontal lines under the sum totals, which are placed on exactly the same line of the page, and bringing down on the opposite side "Balance" with its amount. This will be seen in looking at any of the accounts in the *Ledger*. After this has been done, take all those balances which appear on the debit side of your *Ledger* and add them together. Do the same on the credit side, and if the two sums are equal to each other your books are correct; however, to give positive proof, after the totals of both sides have agreed, see that they agree and are equal with those of the *Journal*. This will give you a double sure proof that your books are correct. The items standing on the debit side of your trial balance sheet should be *Cash in Hand*, *Accounts Receivable*, *Notes Receivable*, *Equipments* and *Stock Inventory*, and on the credit side should appear your *Liabilities*, *Notes Payable*, *Profit and Loss*, if you have made a gain in your business; otherwise *Profit and Loss* will stand on the debit side.

The balance sheet for the Single-entry will be found on previous page, which shows that there has been a loss of $252.52, which is the difference between the $4000.00 started with and the balance, $3747.45, with which we close business. This is a little over 6 per cent. loss. Had the balance been $4210.00 there would have been a profit of $210.00. On the balance sheet for the Double-entry it will appear that there has been a loss of $252.52, as entered in the *Loss and Gain* account.

VOCABULARY OF BUSINESS TERMS

Acceptance.—Agreeing to the terms proposed; the acceptor's name written on the face of a bill of exchange or draft, usually with the word "Accepted."

Accommodation Paper.—Notes or acceptances drawn for the purpose of being discounted, and not founded on an actual sale of goods.

Account Current.—A running account. A detailed statement of the transactions between two persons or firms.

Account Sales.—An itemized statement of sales and expenses, sent by a commission merchant to his principal.

Actuary.—A registrar; a clerk; a person skilled in the application of the doctrine of chances to financial affairs, more especially to insuring of lives.

Adjust.—To put in order; to bring to a satisfactory state, so that parties can agree.

Administrator.—One that is appointed by the court to settle an estate.

Affidavit.—A written declaration under oath.

Agent.—A party acting on behalf of another, called his principal; one commissioned to do business for another; a factor.

Annuity.—A periodical payment of money, amounting to a fixed yearly sum.

Arbitration.—The adjustment of a disputed point by a person or persons chosen by the parties in dispute.

Assessment.—A call upon the holders of stock or policies to pay into the treasury a certain sum in order to pay off debts or effect a re-organization.

Assets.—Funds, property, or effects; the stock in trade, cash, and all the available property of a merchant, in contradistinction to his liabilities or obligations.

Assignee.—A person to whom the property of a bankrupt or an insolvent debtor is transferred for the benefit of creditors.

Assignment.—The act of transferring property to the assignee,

Attachment.—A legal writ for the purpose of seizing a man's property.

Auditor.—An officer appointed to examine and verify claims upon the treasury of a company or society and to investigate the treasurer's accounts.

Balance of Trade.—The difference between the value of our commercial imports and exports.

Bankrupt.—One unable to pay his debts, and takes advantage of the bankrupt law.

Bear.—A person whose interest it is to secure lower prices.

Bill of Exchange.—An order for the payment of money, usually drawn on a person living in a foreign country, *draft* being used to designate bills that are payable in the same country in which they are drawn.

Bill of Lading.—A written account of goods shipped, and the conditions of shipment, having the signature of the carrier's agent, and given the shipper as a receipt.

Bill of Sale.—A writing given by the seller to the buyer, transferring the ownership of personal property.

Bond.—An instrument under seal, by which the maker binds himself, and usually his heirs, executors, and administrators, to do or not to do a specified act. A certificate of ownership of a specified portion of a capital debt due by a government, a city, a railroad, or other corporation, to individual holders, and usually bearing a fixed rate of interest.

Bonded Goods.—Those which are stored in a bonded warehouse, or in bonded cars, the owner having given bonds securing the payment of import duties or of internal revenues, upon their removal or their arrival in some inland city of entry, and before a specified time.

Bonus.—A premium given on a loan, or for any favor shown.

Broker.—An agent who effects sales or purchases, or who makes loans and contracts for another.

Bucket Shop.—A place where bets are made on quotations of prices established on legitimate exchanges and boards of trade. Pretended trading. Illegal in most States. Recently taxed by Revenue Law.

Bull.—A person whose interest it is to secure higher prices.

Bulling.—Raising the price of stocks, etc.

Call Loans.—Money loaned subject to the call or demand of lender. It must be returned the day it is called for before the close of banking hours.

Capital.—The investment in business.

Cash Sales.—The sales made for ready money, in contradistinction to sales on which credit is given.

Certificate.—A written voucher attesting to some fact; as a certificate of deposit, a certificate of stock.

Certified Check.—One which has been certified or accepted by the bank on which it is drawn, making the bank responsible for its payment.

Charter. — A paper from government, defining the rights and privileges of corporations.

Chattel Mortgage.—A mortgage of personal property.

Clearing House.—A kind of banking exchange, established in some of the large cities for the convenience of daily settlements; the drafts and checks on each other are mutually exchanged without the individual presentation of each at the banks, and a balance struck, which balance only is paid in cash.

Collaterals.—Pledges of stocks, notes, chattels, for security of loans and other indebtedness.

Commercial Paper.—Bills of exchange, drafts, and notes given in course of trade.

Commission.—A percentage given for the sale or purchase of goods, or the transaction of other business.

Company.—A corporation. A term also used in a firm name to designate other partners, whose names are not given.

Consignee,—One to whom goods are sent.

Copartnership. — A joining of two or more persons into one firm for the purpose of carrying on any enterprise. It has the same meaning as a partnership.

Corner.—An artificial scarcity created by holding property off the market for the extortion of abnormally high prices.

Coupon.—An interest note or a certificate attached to a transferable bond, cut off from the bond and collected when due.

Creditor.—One giving credit; one whom we owe.

Custom-House.—A government place where imported goods are entered and duties collected.

Days of Grace.—Negotiable promissory notes or bills of exchange, payable at a certain time, are in most places entitled to three days' delay beyond the time expressed, which are called days of grace.

Debenture.—A writing acknowledging a debt; a writing signed by a public officer or corporation as evidence of debt.

Debenture Bonds. — Concentration of floating capitalization into convenient bonded form. Originally, notes in the form of bonds.

Deed.—A written contract under seal, usually transferring the ownership of real estate.

Defalcation. — Deduction or discount. Embezzlement of money by an officer having it in charge.

Default. — The failure to pay fixed charges or interest coupons. This is a serious thing for a corporation, and usually causes a heavy shrinkage in value.

Discount.—An amount deducted from the regular price or list.

Discount Rate,—The rate per cent. of interest charged by banks for the use of money loaned. It is always deducted from the principal when the loan is made.

Dishonor.—A failure to pay an obligation when due; a failure to accept a draft when presented for acceptance.

Dividend.—The proportion of the profits alloted to each stockholder in a company.

Executor. — One appointed to execute the will of another.

Exporting Countries.—Those producing a surplus of grain which finds a market in other countries where there is a deficiency. The principal ones are the United States, Russia, Argentina, Hungary, India, Roumania, and Australia.

Extension. — An allowance of further time for the payment of a debt.

Falling Market.—A continuous decline in prices.

Favor. — A note, draft, or check is drawn in favor of the party to whom it is made payable; a letter.

Fee Simple.—The absolute ownership of real estate.

F. O. B.—Free on board or free of all shipping expenses.

Good Will.—The reputation and patronage belonging to an established business. The good will of a business is frequently the subject of purchase and sale.

Honor.—To accept or pay draft when due.

Hypothecating.—Putting up collaterals for loans.

Importing Countries. — The United Kingdom, Germany, France, Italy, Belgium, Holland, Spain, Brazil, the West Indies, China, and Japan, because they produce less grain than is required for home consumption.

Insolvency.—Inability to pay debts or meet commercial obligations.

Insolvent.—Unable to pay one's debts; one who is insolvent.

Inventory.—A schedule or list of the goods, wares and merchandise generally, credits and assets of a merchant.

Invoice.—An itemized bill of merchandise bought, sold or shipped.

Jobber.—A wholesale merchant who buys goods from the importers and manufacturers, and sells to retailers.

Judgment.—The decree of a court enforcing a contract or redressing a wrong.

Liabilities.—The pecuniary obligations of a merchant, which include bills payable and all other debts.

Margin.—Money or collaterals deposited with a broker to protect contracts.

Mortgage.—The written pledge of real estate or chattels to secure payment.

Negotiable.—A term applying to commercial paper, that may be transferred by indorsement or simply by delivery.

Net Proceeds.—The proceeds of a sale after all expenses are deducted.

On Call.—Money loaned "on call" must be returned the day it is called for, before the close of banking hours, and without previous notice.

Open Account.—An unsettled account.

Option.—Property bought or sold at the call or demand of the buyer or seller, as may be specified; a conditional contract.

Outlawed.—Term applied to a debt or note which has run beyond the time when payment can be enforced by law.

Outstanding.—Unsettled; unpaid.

Overdrawn.—To draw a greater sum than one has to his credit.

Par Value.—Nominal value; usually the printed or written value of any paper.

Power of Attorney.—A written instrument giving an agent authority to act for his principal. An agent thus empowered is called an Attorney in Fact.

Protest.—A formal declaration made by a notary public of the non-payment, non-acceptance of a note or a draft.

Receiver.—A person appointed to take charge of the affairs of a corporation on its dissolution, and to distribute its property according to law.

Resources.—Money, property, or that which can be converted into property.

Renewal of a Note.—Extending the time of its payment by giving a new Note in exchange for it.

Sinking Fund.—A sum of money set apart for the redemption of the debts of a corporation or government.

Solvent.—Able to pay one's liabilities

Spot Cash.—A term applied to a sale of goods to be paid for on delivery, *i. e.*, C. O. D.

Stock.—Certificates issued by a corporation certifying that the person in whose name they are written and stand registered on the corporation books is entitled to share in the company's profits, to vote, etc.

Syndicate.—A number of capitalists who unite together to dispose of a large loan, or to conduct some great financial enterprise.

Trade Discount.—A discount from certain list-prices, or from the amount of purchases, made to a dealer on account of a change in the prices, or for cash payments.

Trust.—A combination of manufacturers or dealers for the purpose of limiting production and advancing prices for their own benefit.

Valid.—A term applied to a contract that is properly executed; that is, legal or binding.

Void.—Having no legal or binding force.

Watered Stock.—An increase in capitalization without a corresponding increase in assets.

Without Recourse.—Not liable as an indorser if written over an indorser's signature on the back of commercial paper.

Warranty.—An agreement to become responsible, if certain facts do not turn out to be as represented.

RAPID CALCULATIONS

SHORT CUTS TO RESULTS—TIME-SAVING PROCESSES—INTEREST TABLES AND WAGES CALCULATIONS—HOW TO HANDLE FRACTIONS

QUICKNESS IN FIGURES

Book-keepers, bank clerks and others who have constant calculations to make need to be both expert and rapid. There are many short cuts practiced which every person should know, and a few of the most important are here explained.

Adding Quickly.

The art of adding quickly is acquired by learning to *read* a column of figures as you would a sentence of words, and those words composed of letters.

By *Practice* we may become so familiar with figures that when we see a group of them, we can tell at a glance what the sum of them reads, without spelling the figures at all. In practicing the reading of a column of figures in this way, we do not let the brain work at all, but simply pass the eye over the figures slowly at first, but increase the speed as proficiency is acquired.

A few minutes' daily practice will produce astonishing results in a very short time; beginning with two figures, then three, four, and so on until finally we become able to write the *Sum* total of long columns. For example, when we see the figures 9, 8, 6, 4, we know at a glance that the sum is 27 without reading the figures themselves or spelling them out.

Reading a column of figures is done by dividing a large group of figures into smaller ones and from group to group through the column, just as from word to word we read through a sentence.

The most important qualities of an accountant are accuracy and speed. The most speedy calculators are usually the most correct.

No labor should be regarded too great to master this, the key to all numerical as well as business transactions.

2. **To multiply by numbers ending or beginning with** 1; as 21, or 31, or 13, or 17, or 51, or 501, or 103, or any number of two figures where one of them is 1, or of three figures where two of them are 0 and 1, a good deal of time can be saved by abbreviating the ordinary process, as below:

RULE I. *When the 1 stands at the right*, multiply by the figure at its left, and place the product under the place of *tens* under the number to be multiplied. Add the two together, and their sum is the product.

If the multiplier is 201, or 301, or 401, or any number of hundreds, place the product two places to the left. *If the multiplier is* 2001, or any number of thousands, place the product three places to the left. In other words, the product of hundreds under hundreds' place; of thousands under thousands' place, etc.

RULE II. *When the 1 stands at the left of the multiplier*, multiply by the number at the right, and place the product under the multiplicand one place to the right of the units' place. The second figure of the product under units' place of the multiplicand.

EXAMPLES. 231423×21=4859883.
231423=231423×1
4628460=231423×20

4859883=product.

20213 ×13   20213×201
60639   40426

262769=product.   4062813=product.

EXAMPLES FOR PRACTICE. 2134×11; 6215×11; 2143×11; 3212×11; 4215×11; 2153×21; 1024×31; 8461×41; 2222×14; 3120×19; 2132×201; 2146×102; 9842×301; 8002×402; 4621×105.

3. Short Cuts in General Multiplication.

EXAMPLE 1. Multiply 96 by 97.
96 . . . 4 (Complement.)
97 . . . 3 (Complement.)

9312

The *complement* of a number is the difference between the number and the unit of the next higher order, thus the complement of 96 is 4 (100-96); of 97 is 3; of 987 is 13, etc. To multiply these two numbers, multiply the complements 4 and 3, and place the product, 12, in the answer. For the remaining two figures subtract across, either the 4 from the 97, leaving 93, or the 3 from the 96, leaving 93. Apply this rule to the first and second lines of exercises below.

EXAMPLE 2. Multiply 37 by 43.

The mean number—that is, the number which is as much greater than 37 as it is less than 43—is 40. Forty squared, or multiplied by itself, gives 1600. The square of 3, the difference between the mean number and one of the numbers is 9. 1600—9=1591=the product of 37 and 43. Apply this rule to the exercises below.

EXAMPLE 3. Multiply 76 by 46.
46   6×6=36, carry 3.
76   6× (7+4)=6×11=66, and 3 carry 69.
3496   4×7=28, and 6 to carry, 34.

Multiply units by units for the first figure of the product, the sum of the tens by units for the second figure, and tens by tens for the third figure, carrying when necessary. A similar rule applies to numbers having the left-hand figures the same. Work the following exercises.

EXERCISES. 97×98; 95×94; 97×96; 95×93; 93×97; 97×94; 99×89; 994×995; 993×994; 989×998; 992×995; 988×997; 976×999; 954×998; 87×73; 63×57; 42×38; 45×35; 116×124; 1012×988; 1025×975; 56×56; 72×32; 87×37; 61×63; 114×114; 137×177; 125×112.

4. Short Cuts in Multiplication and Division by Special Numbers.

To multiply any number by 25, add two ciphers, and divide the number by 4.

To multiply any number by 125, add three ciphers, and divide the number by 8.

To multiply a number by any number of *nines*, add as many ciphers to the number as there are *nines*, and from this subtract the original number.

5. Short Multiplication and Division in Fractional Numbers.

To multiply any number by 2½, add one cipher, and divide by 4.

To multiply any number by 3⅓, add one cipher, and divide by 3.

To multiply by 33⅓, add two ciphers and divide by 3.

To multiply any number by $1\frac{3}{7}$, add one cipher, and divide by 7.

To multiply by 16⅔, add two ciphers, and divide by 6.

To multiply by $14\frac{2}{7}$, add two ciphers, and divide by 7.

To multiply by 875, add three ciphers, multiply by 7 and divide by 8.

To divide by 25, multiply by 4, and cut off two figures.

To divide by 125, multiply by 8, and cut off three figures.

To multiply by 12½, add two ciphers, and divide by 8.

To divide by 12½, multiply by 8, and cut off two figures at the right.

To divide by 33⅓ multiply by 3, and cut off two figures at the right.

Practical Applications.—To find the value of any number of articles at 75 cents each, say 248 yards of cloth at 75 cents a yard, deduct one-quarter of 248 from it, and call the remainder dollars. At a dollar a yard the result will be $248; then at 75 cents it must be $248—(¼ of 248)=$186.

Find the cost of 84 yards of cloth at 12½ cents a yard.

What will 328 bags of potatoes cost at 75 cents a bag?

Find the cost of 20 gross of pen-handles at 25 cents each.

What will 216 pounds or raisins cost at 16⅔ cents a pound?

A railway charges a cent a mile, for the first 50 miles, for carrying a cord of wood, and then 3 cents for every 4 miles beyond the 50; what will it cost to carry 250 cords 90 miles?

If a clerk receives $640 a year, and his expenses are $325 a year, how many years will it take him to pay for a 56-acre farm at $45 an acre?

A fruit dealer bought 5 bushels of cherries at $2.50 a bushel, and sold them at 15 cents a quart; did he gain or lose, and how much?

6. Other Short Fractional Multiplication.

To multiply any number containing ½, such as 7½, 19½, 12½, etc., by itself, multiply the whole number by the next higher whole number, and annex ¼ to the product. Thus, 7½ × 7½ = 7 × 8 + ¼ = 56¼; and 19½ × 19½ = 19 × 20 + ¼ = 380¼. Apply this rule to the first column of exercises below.

To multiply two fractional numbers, such as 7¼ and 7¾, multiply 7 by 8, and add to the product the product of ¾ and ¼, or $\frac{3}{16}$, and you have the correct product. Apply this rule to the second column of exercises below.

To multiply two fractional numbers, each containing ½, such as 5½ by 7½, add the product of the whole numbers, plus ¼ to ½ of the sum of the whole numbers. Thus, 5×7=35; 35+½ (5+7)=35+6=41, and to this add ¼, making 41¼, the product. Apply this rule to the third column of exercises below.

To multiply two fractional numbers each containing ¾, such as 11¾ by 13¾; to the product of the whole numbers add the product of their sum by ¾, after which add the product of ¾ by ¾. This rule applies in all cases where both fractions are the same. Apply it in working the fourth column of exercises below.

Examples for Practice.

6½ × 6½	5¼ × 5¾	2½ × 5½	2¾ × 4¾
4½ × 4½	8¼ × 8¾	4½ × 6½	3¼ × 3¼
5½ × 5½	9⅓ × 9⅔	2½ × 8½	8¾ × 2¾
8½ × 8½	6⅘ × 6⅕	9½ × 8½	8⅗ × 4⅗
12½ × 12½	2⅖ × 2⅗	2½ × 7½	9¼ × 4¼
10½ × 10½	9⅓ × [illegible]	1½ × 9½	8⅓ × 2⅓

7. To Multiply Numbers Ending in 5.

To multiply two small numbers each of which ends in 5, such as 35 and 75, take the product of the 3 and 7, increase this by one-half of the sum of these figures, and prefix the result to 25. Thus,

35   5×5 = 25
75   7×3 = 21, 21+½ (7+3)=26
———
2625

This rule will be found to hold good with any two numbers each of which end with 5. Apply it to the examples below:

Examples for Practice. 45×85; 95×25; 35×65; 75×95; 85×55.

8. To Multiply Special Large Numbers.

In the multiplication of large numbers, where one part of the multiplier is a *multiple* of the remainder, the work can always be considerably abbreviated. See the examples below:

2043
427 = 420 + 7 = (7×60)+7
———
14301 = 2043×7
858060 = 2043×420 = 14301×60
———
872361 = product.

3142
972 = 900+72 = 900+(9×8)
———
2827800 = 3142×900
226224 = 3142×72 = 28278×8
———
3054024 = product.

We first multiply by 7, then by 420, thus taking the number 2043, 427 times. The contraction is made in multiplying by 420. We take its factors, 7 and 60; we have already multiplied by 7, so that all that remains to be done is to multiply 14301 by 60 and place it under. The sum of the two partial products gives the whole product. As a test exercise, multiply some number by 14412 so as to have only two lines instead of five to add. See exercises in second and third columns below:

Remember, that any number is *divisible by 3* if the sum of its digits is divisible by 3; that any number is *divisible by 5* if its right-hand figure is 5 or 0; that any number is *divisible by 9* if the sum of its digits is divisible by 9.

Exercises.—2013×927; 1214×279; 3135×728; 2146×287; 3210×189; 21401 ×729; 31252×14412; 42001×70357; 15421 ×81273; 30012×94572.

Lightning Table for Marking Goods Bought by the Dozen.

Retailers buy most of their articles by the *dozen*, such as boots, shoes, hats, caps, and notions of various kinds. A vast amount of time is employed in marking goods by the old process, and errors are frequent, owing to the unnecessary figures used. If the purchaser will commit to memory the following table, he can instantly find the retail price of a single article with any desired business per cent. added. The following per cents. are those generally used in business:

To make		Divide the cost per doz. by		
20	per cent.	10		
33⅓	"	9		
50	"	8		
100	"	6		
40	"	10, and add	1-6	itself.
35	"	10 "	1-8	"
37½	"	10 "	1-7	"
30	"	10 "	1-12	"
25	"	10 "	1-24	"
12½	"	10 and subtract	1-16	"
16⅔	"	10 "	1-36	"
18¾	"	10 "	1-96	"

S. T. Jones purchased one dozen hats for $27.00, and marked them to sell at a profit of 33⅓ per cent. What was the retail price of a single hat?

Explanation.—According to table, simply divide the cost per dozen by 9.

9) $27.00
Ans. $3.00

For how much must I sell books bought at $28.00 per dozen, to gain 25 per cent?

Explanation.—Removing the point one place to the left, on $28.00 we get $2.800. Now add 1-24 itself and we have $2.91+ ans.

24) 2.800
.11
$2.91+

The above table should be committed to memory.

Board Bills, Day or Week.

The following tables will also answer for calculating the amount of wages by the week or month of hired girls, servants, etc., who are compelled to labor on the Sabbath; being calculated for seven days in the week instead of six.

Multiply these tables by 4, and you have wages by the month:

At $2.00 a wk.			At $2.25 a wk.			At $2.50 a wk.			At $3.00 a wk.		
Dys.	$	Cts.	Dys.	$	Cts.	Dys.	$	Cts.	Dys.	$	Cts.
1		28½	1		32	1		35¾	1		43
2		57	2		64¼	2		71½	2		85¾
3		85¾	3		96¼	3	1	01¼	3	1	28¾
4	1	14¼	4	1	28½	4	1	43	4	1	71½
5	1	42¾	5	1	60½	5	1	78¾	5	2	14¼
6	1	71¼	6	1	92¾	6	2	14¼	6	2	57
7	2	00	7	2	25	7	2	50	7	3	00

NOTE.—To find the daily rate at $4 per week, double the $2 rate; at $4.50, double the $2.25 rate, etc., etc. This table thus suffices for all the usual rates of board from $2 to $15 per week.

Wages per Hour Under a Daily Contract.

At 50 cts. a day. Showing the rate of wages per hour, for 12 hours a day.			At 75 cts. a day. Showing the rate of wages per hour, for 12 hours a day.			At $1.25 a day. Showing the rate of wages per hour, for 12 hours a day.			At $1.75 a day. Showing the rate of wages per hour, for 12 hours a day.		
Hrs.	$	Cts.	Hrs.	$	Cts.	Hrs.	$	Cts.	Hrs.	$	Cts.
1		4¼	1		6¼	1		10½	1		14½
2		8½	2		12½	2		21	2		29
3		12½	3		18¾	3		31¼	3		43¾
4		16¾	4		25	4		41¾	4		58¼
5		21	5		31¼	5		52¼	5		72¾
6		25	6		37½	6		62½	6		87½
7		29½	7		43¾	7		73	7	1	02
8		33½	8		50	8		83½	8	1	16½
9		37½	9		56¼	9		93¾	9	1	31¼
10		41¾	10		62½	10	1	04¼	10	1	45¾
11		46	11		68¾	11	1	14¾	11	1	60¼
12		50	12		75	12	1	25	12	1	75

NOTE.—To find hourly rate at $1 per day, double the 50c. rate; at $1.50 per day, double the 75c. rate; at $2 per day, multiply 50c. rate by 4; at $2.50 per day, double the $1.25 rate; at $3 per day, multiply 75c. rate by 4; at $3.50 per day, double the $1.75 rate, etc.

Daily Rate of Wages Under a Weekly Contract.

At 62½ cts per day, or $3.75 per week.			At $1.00 per day, or $6,00 per week.			At $1.25 per day, or $7.50 per week.			At $1.50 per day, or $9.00 per week.		
Dys.	$	Cts.	Dys.	$	Cts.	Dys.	$	Cts.	Dys.	$	Cts.
¼		15½	¼		25	¼		31¼	¼		37½
½		31¼	½		50	½		62½	½		75
¾		47	¾		75	¾		93¾	¾	1	12½
1		62½	1	1	00	1	1	25	1	1	50
1¼		78	1¼	1	25	1¼	1	56¼	1¼	1	87½
1½		93¾	1½	1	50	1½	1	87½	1½	2	25
1¾	1	09¾	1¾	1	75	1¾	2	18¾	1¾	2	62½
2	1	25	2	2	00	2	2	50	2	3	00
2¼	1	40½	2¼	2	25	2¼	2	81¼	2¼	3	37½
2½	1	56¼	2½	2	50	2½	3	12½	2½	3	75
2¾	1	72	2¾	2	75	2¾	3	43¾	2¾	4	12½
3	1	87½	3	3	00	3	3	75	3	4	50
3¼	2	03¼	3¼	3	25	3¼	4	06¼	3¼	4	87½
3½	2	18¾	3½	3	50	3½	4	37½	3½	5	25
3¾	2	34½	3¾	3	75	3¾	4	68¾	3¾	5	62½
4	2	50	4	4	00	4	5	00	4	6	00
4¼	2	65¾	4¼	4	25	4¼	5	31¼	4¼	6	37½
4½	2	81¼	4½	4	50	4½	5	62½	4½	6	75
4¾	2	97	4¾	4	75	4¾	5	93¾	4¾	7	12½
5	3	12½	5	5	00	5	6	25	5	7	50
5¼	3	28¼	5¼	5	25	5¼	6	56¼	5¼	7	87½
5½	3	43¾	5½	5	50	5½	6	87½	5½	8	25
5¾	3	59½	5¾	5	75	5¾	7	18¾	5¾	8	62½
6	3	75	6	6	00	6	7	50	6	9	00

Rapid Method for Counting Interest.

The method of reckoning interest generally used by the best accountants and bookkeepers is what is known as the sixty-day method. By this method 360 days are reckoned as a year and 30 days as a month. Six per cent. for 12 months, or 1 year, is equivalent to 1 per cent. for 2 months, or 60 days, and 1 per cent. of any number is easily found by moving the decimal point two places to the left. Therefore, the interest on any amount at 6 per cent. per annum for 2 months, or 60 days, may be found by moving the decimal point two places to the left. Having found the interest for 60 days, in order to find it from that amount for any number of days, simply divide them into aliquot parts of 60.

EXAMPLE 1: Interest on $128 for 90 days.

1.28 = interest for 60 days.
.64 = interest for 30 days.

1.92 = interest for 90 days. 60+30.

EXAMPLE 2: Interest on $185.40 for 47 days.

1.8540 = interest for 60 days.

.9270 = interest for 30 days, ½ of 60.
.4635 = interest for 15 days. ½ of 30.
.0618 = interest for 2 days, $\frac{1}{15}$ of 30.

1.4523 = interest for 47 days. 30+15+2.

Interest Table.

The interest on any sum of money may readily be found by means of the following table showing the interest on $1 at various rates and times:

	5%	6%	7%	8%		5%	6%	7%	8%
Yr.					Yr.				
1	.05	.06	.07	.08	4	.20	.24	.28	.32
2	.10	.12	.14	.16	5	.25	[illegible]	.35	.40
3	.15	.18	.21	.24	6	.30	.36	.42	.48
Mo.					Mo.				
1	.00416	.005	.00583	.00666	7	.02916	[illegible]	.04083	.04666
2	.00833	.01	.01166	.01333	8	[illegible]	.04	.04666	.05333
3	.01250	.015	.01750	.02000	9	.03750	.045	.05250	.06000
4	.01666	.02	.02333	.02666	10	.04166	.05	.05833	.06666
5	[illegible]	.025	.02916	.03333	11	.04583	[illegible]	.06416	.07333
6	[illegible]	.03	.03500	.04000					
Da.					Da.				
1	.00013	.00016	.00019	.00022	16	.00222	.00266	.00311	.00355
2	.00027	.00033	.00038	.00044	17	[illegible]	[illegible]	[illegible]	.00377
3	.00041	.00050	.00058	.00066	18	[illegible]	.00300	[illegible]	.00400
4	[illegible]	[illegible]	.00077	.00088	19	[illegible]	.00316	[illegible]	.00422
5	[illegible]	.00083	.00097	.00111	20	.00277	[illegible]	[illegible]	.00444
6	[illegible]	.00100	.00116	[illegible]	21	.00291	[illegible]	[illegible]	.00466
7	.00097	.00116	[illegible]	.00155	22	[illegible]	[illegible]	.00427	[illegible]
8	.00111	[illegible]	[illegible]	.00177	23	.00319	[illegible]	.00447	.00511
9	.00125	.00150	.00175	.00200	24	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	.00166	.00194	.00222	25	.00347	.00416	[illegible]	[illegible]
11	.00152	[illegible]	[illegible]	.00244	26	[illegible]	[illegible]	[illegible]	.00577
12	[illegible]	.00200	[illegible]	.00266	27	.00375	.00450	[illegible]	.00600
13	.00180	.00216	.00252	.00288	28	[illegible]	.00466	.00544	.00622
14	.00194	.00233	.00272	.00311	29	.00402	.00483	.00563	.00644
15	.00208	.00250	.00291	[illegible]					

Find interest for $1 in this table at given per cent. for given number of years, months and days and multiply by the given amount.

Table Showing How Many Days a Note Has to Run.

The following table will be found very useful to book-keepers in calculating the number of days a note has to run:

	TO											
FROM	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
January	[illegible]	31	59	90	120	151	181	212	243	273	304	334
February	334	365	28	59	89	120	150	181	212	242	273	303
March	306	337	365	31	61	92	122	153	184	214	245	275
April	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	214
June	214	245	273	304	334	365	30	61	92	122	153	183
July	184	215	243	274	304	335	365	31	62	93	123	153
August	153	184	212	243	273	304	334	365	31	61	92	122
September	122	153	181	212	242	272	303	334	365	30	61	91
October	92	123	151	182	212	243	273	304	335	365	31	61
November	61	92	120	151	181	212	242	273	304	334	365	30
December	31	62	90	121	151	182	212	243	274	304	335	365

The table gives the number of days intervening between any day in any month to a similar date in any other month. To ascertain these intervening days, run the eye along the line designated by title of the month on the left hand, until it reaches its intersection by the column headed at the top, by the month in which the note matures, and the figures at the angle denote the number of days from the first of the respective months. To this add the day upon which the note matures, and from the sum subtract the date of the month from which it is reckoned.

EXAMPLE.—A note falling due June 26th is offered for discount on March 10th; wanted, the number of days intervening before maturity.

The figures at the angle give . .	92
Add date of note's maturity . .	26
	118
Deduct date of discount . .	10
Days to run	108

BOOK IV.

EVERY-DAY MECHANICS FOR MAN AND BOY

A PRACTICAL GUIDE TO THE USE OF TOOLS, SELECTION AND PURCHASE OF MATERIALS—HELPFUL AIDS IN CARPENTRY, PLUMBING, BRICK AND STONE WORK, PAINTING, PAPER HANGING AND OTHER BUILDING TRADES—THE MANIPULATION OF ELECTRICAL APPLIANCES—WORKSHOP RECIPES AND PRACTICAL MEASUREMENTS AND ESTIMATES.

EVERY MAN HIS OWN MECHANIC

Use of Tools Around the House

These two pictures illustrate the use to which a knowledge of practical mechanics may be put in keeping everything about the house in good repair without the expense of calling in a workman for many small jobs.

The upper picture shows a house in which things have got out of order and the occupants have been either unskilled in simple carpentry and painting or reluctant to send for a high-priced man to put them right.

The lower picture, on the other hand, shows how trim and attractive a house may be kept at small cost if the trifling breaks and results of wear are attended to at once by a man or boy who is handy with a few tools.

THE PRACTICAL MECHANIC

HOW TO MAKE YOUR OWN REPAIRS—HELPS IN CARPENTERING, BRICKLAYING, METAL WORKING, PAPER HANGING, AND OTHER USEFUL OCCUPATIONS—INSTALLATION OF ELECTRIC BELLS, TELEPHONES AND OTHER MECHANICAL APPLIANCES—PRACTICAL RECIPES AND DIRECTIONS.

EVERY MAN HIS OWN MECHANIC

Mend your broken chairs and crippled furniture; put fresh panes of glass into your broken windows; do your own repairs as far as it is practicable, indoors and out of doors; look after your own locks and fastenings; make your own garden tools and appliances; put up your own sheds, greenhouses, and garden buildings, and I shall answer for it that if you check what you save on each job, you will find yourself in pocket at the end of the year merely through resorting to self-help.

Let us take a simple case of common occurrence, as for example, a broken window, and see, by comparing the cost of repairs when executed by a glazier on the one hand, and done by the householder himself on the other, how much may be saved by means of a little practical knowledge and self-help.

Broken Window, How to Mend It.

We shall first look into the cost of the work when the householder is his own mechanic. The man who lays himself out to do odd jobs of this kind will of course have at hand the tools necessary for carrying out the work, namely, a hammer, a suitable knife for hacking out or cutting away the hardened putty and fragments of glass still remaining in the window frame, and a putty knife. The first thing to be done is to clear the rebate or groove in the sash-frame for the reception of the new pane The next step is to measure accurately the length and breadth of the aperture, including the rebate, and procure a piece of glass of the required size from any painter and glazier or store which cuts glass for those who may require it. A little putty must also be procured. Now, supposing, that the glass measures 18 in. by 12 in., or, in other words, contains one and a half superficial feet, the cost of the glass will be 10 cents. The cost of the putty may be reckoned at 1 cent, putty generally speaking being 5 cents per pound, though it may be frequently purchased at the paint store for 4 cents per pound. The expense, then, of putting things as they were before to the householder who can use his hands is no more than 11 or 12 cents. It will cost 25 cents or more if a journeyman is called in.

It may be argued that a man who aspires to be his own mechanic cannot possibly gain a sufficient knowledge of all or any of the various building trades to enable him to do the necessary work of construction or repairs in a workmanlike manner, and that even if he could do so he would never be able to find time enough to do all that may be wanted in house and garden from year's end to year's end. Yet, so far as time is concerned, it may be pointed out at once that the most hard-worked man has his regular or occasional half-holiday, to say nothing of the summer evenings when there is light enough for handi-craft work even after 8 o'clock; and if these be not enough, he must—as people are often told to do who object that they can find no time for this, that, and the other—MAKE time.

Knowledge Must Be Paid For.

It is good policy, then, for every man who seeks to do a little as a handicraftsman, to lay out a few dollars in obtaining the services of any moderately skilled artisan, who, for such a sum, would willingly show the aspirant how to use his tools, and how to keep them in working order. Thus, for example, if a man desired to follow up carpentry, it will be beneficial to him in the highest degree to enlist the services of a carpenter who will show him how to use his saw and his plane, and how to keep his saw fit for use by sharpening it with a file, and his plane and other cutting tools in proper condition by means of the grindstone and oilstone. If, again, he wished to be able to build a brick wall, he should get a bricklayer to show him how to prepare his foundations with spade and level, and how to put in the footings of his wall, and to raise it, course after course, so that its faces within and without, may be truly perpendicular, inclining neither to the one side nor the other. Having once learned *how* to do a thing, a fairly intelligent man will not require so very much practice to enable him to do such work as inclination or necessity may suggest, in a tolerably workmanlike manner.

Carpentry Most Desirable.

If it be asked what branch of handicraft trade, or, to bring matters within a narrower compass, what branch of the building trade is most suitable and most useful for amateurs generally, and householders especially, it must be answered that a knowledge of carpentry and joinery will be found by far the most desirable. Next to this, it is necessary to know something about painting and glazing, which comes fairly within the province of the amateur. Collaterally with these useful arts, paper-hanging may be mentioned. It is unlikely that a man will do much smith's work, but even in this it is possible for an amateur to do something, and a slight acquaintance with the arts of brazing, soldering, and working in metals will enable a man to make propagating cases that shall do him good service, and apparatus for heating a small greenhouse, if he have one, at little expense, even if he still leaves it to the peripatetic knife-grinder and tinman to stop up holes in leaking coffee-pots and saucepans, and to renew the damaged bottoms of colanders and milk-strainers.

Bricklaying and Masonry.

Bricklaying and masonry are trades which possibly an amateur will not meddle much with; but some slight acquaintance with the principles of each, and the materials employed, is desirable, even if it be for no other or better purpose than that of giving an eye to any workman who may be employed in this way on the premises, in order to see that he is doing his work in a workmanlike manner, that he is using proper materials, and that he is not wasting his time—a thing which no workman who has any self-respect will do. It is, however, quite as well to be able to know oneself how to set a stone or step that has become loose by one cause or another, in cement, and how to prepare the cement for the work; and know in what proportions sand and cement should be mingled for the purpose of making a suitable composition for fixing the step once again, so that it may remain immovable in its proper position.

Excavating.

Lastly, a knowledge of excavating in all its branches is attended with advantage. In the term "excavating" a far greater variety of work is comprised than appears upon the face of it at first sight. It means far more than digging or hollowing out a pit, as for a well or a trench, or for the foundation of a wall. It embraces these, it is true, but it also implies a knowledge of the manufacture—if we may use the word—

of concrete, and the purposes to which it is put, of making garden walks and paths, and of leveling, so far as it may be applied to the construction of drains for carrying off the surplus water from the soil of the garden, or even from a stable or pigsty, and the laying of drain-pipes for this purpose. It also gathers within its wide embrace a knowledge of the method of making tar paving and burning clay into ballast—processes which will often be found extremely useful in the garden.

Kinds and Prices of Materials.

It is important for every one who attempts to work in wood that he should be familiar with the various kinds of wood that are used, and the purposes for which each is specially adapted. Experience will show that wood which is admirably fitted for one kind of work is by no means suitable for another. The prices, too, of different sorts of wood differ as much as their qualities, and it is desirable that the amateur artisan should become acquainted with these to some extent, that he may know what he is about when he is making purchases of his timber merchant. A knowledge of the prices of the different kinds of wood used in building and furniture making will also be useful to him in other ways. For example, if he intends to put up even so unambitious a structure as a weather-boarded shed, he can, after making his plans and working drawings, calculate to a nicety the quantity of wood that will be wanted, and its cost at the timber yard; and if he finds that the job will run into more money than he expected, he can modify his plans and the mode of structure to suit his pocket.

Working Drawings.

We would urge strongly on the amateur artisan the necessity of preparing careful plans and working drawings to scale of any piece of work that he is about to take in hand, whether large or small, before he attempts to put it in hand. It is an old but true saying, that "Well begun is half done," and the worker in wood or stone or any other building material will be led to appreciate its truth and wisdom when he finds how helpful the making of correct and careful plans and drawings will be to him in the actual performance of the work in question. The whole mode of procedure—what he has to do and how he must do it—will be clearly fixed in his mind before he even touches the material which he is about to work up into the desired form or object, and he will always find the execution of the work to be quicker or slower, according to the extent to which he has previously worked out his plans in his mind, and committed them to paper.

Kinds of Woods Generally Used in Ordinary Carpentry.

Of all the different kinds of wood, deal, or pine, is that with which the amateur will be most frequently employed, and of which it is most necessary that he should know the prices and sizes at and in which it can be procured at the timber yard. We shall now endeavor to convey some idea of the nature of a few common kinds of wood, and the purposes for which they are or may be used.

THE ASH is a hardy deciduous tree, found generally in northern latitudes. In color the wood is greenish white when young, but the grain of timber cut from old trees is often dark and beautifully marked. When in this condition it is frequently used by the cabinet-maker. Its toughness, elasticity, and closeness of grain render the wood useful for making the frames of carriages, agricultural implements, felloes of wheels, etc. Hammer handles and billiard-cues are frequently made of Ash, as well as the handles of croquet-mallets, and it is much used by coopers. It admits of being bent almost double without snapping, and on that account it is well adapted to be used for curved work.

THE BEECH, a hardy deciduous tree, is found in the northern States and Canada. The color varies; it is mostly light or whitish brown in tint, but is found in all shades of brown, deepening at times to black. The wood is fine and straight-grained, and is, in consequence, easily worked. The grain resembles that of mahogany, and it is often stained to represent it. It is used in the manufacture of furniture-tables, beds, and chairs being made of it. It may be stained to imitate ebony and rosewood.

The BIRCH is a forest tree of graceful appearance, found in cold and temperate regions, and on elevated situations, such as the sides of mountains in warmer countries. The wood is white, firm, and tough, and is used especially in northern countries for making wheels, casks and tubs, and in turnery.

The wood known as CHESTNUT is derived from two widely different kinds of trees—the Horse Chestnut and the Spanish or Sweet Chestnut. The white brittle wood of the Horse Chestnut is used by turners in making fancy goods. The wood of the Sweet, or Edible, Chestnut, is hard and durable, and beautifully grained and variegated. Furniture is sometimes made of it, and it is used with effect for decorative purposes in building.

The name of PINE is given to the timber of a great variety of cone-bearing trees, although the deal or pine cut from different trees varies considerably in quality and general utility. It may be broadly distinguished as Red or Yellow Pine—for the names are indifferently used—and White Pine. In the one kind, the ground color of the wood is yellow, diversified with markings of pale red; in the other kind,the wood is of a whitish color, whence its name. The American White Pine is highly esteemed in carpentry work from its softness and the ease with which it can be worked. While not strong, it is durable. The difference in the two kinds of wood is this: the grain of the Yellow Pine is generally very straight and free from knots, and it is very durable, though it is soft and easily worked. This renders it peculiarly appropriate for all building purposes, whether in the construction of houses or ships. The great height and straightness of the pine renders it well suited for the masts of ships; and when stained and varnished the timber presents a handsome appearance for joiners' work in houses. White Pine is harder and not so straight-grained as Yellow Pine, and it is generally full of knots. The variety known as Silver Fir is used for flooring, and also in the manufacture of household furniture.

The OAK. The best Oak timber in the world is grown in America and Great Britain, from whose forests, until iron came so much into use for ship building, all the Oak was derived for the splendid fleets which have commanded the sovereignty of the seas. Although the grain is somewhat open—too open, indeed, for the purposes of the turner—the wood is extremely hard and durable, but difficult to work, and apt to take the edge pretty quickly off the workman's tools. The wood is dark in color and susceptible of a high polish. It is much used in house building, for houses of the better class, for floors, staircases, doors, the paneling of rooms, etc., and for tables, chairs, sideboards, and other pieces of household furniture.

The POPLAR. This wood is white, soft, and brittle, and is chiefly used in the manufacture of boxes, cases, and children's toys. The softness of the wood causes glass grinders and lapidaries to use horizontal sections as polishing wheels. The wood of the poplar is not liable to shrink, warp, or swell. The fret-sawyer will find it useful for backgrounds, linings, and veneered work.

The wood of the WALNUT is extremely useful and valuable, and is used in the arts for many purposes, of which not the least important is that of the manufacture of ornamental furniture. Its only drawback is its want of density, which renders it liable to injury from blows and rough usage. It is as useful to the turner as to the cabinet-maker, and works well in the lathe. It is desirable to get walnut wood from old, well-grown trees, for the older the tree the more beautiful and diversified are the markings of the wood.

For fret-sawing and all kinds of cabinet work, the wood known as BLACK WALNUT is the most suitable. Unless well seasoned by kiln-drying, or some similar process, it is apt to warp and split. It will take a beautiful polish, and still look well. Plain oiling seems to harden the fibre, and a dead polish will often show better in the work than though it shone like a mirror. This wood ought never to be varnished, since this gives a common look to the article, as it always brings out the grain.

The WHITE WALNUT, known in the United States as the *butternut*, is a pretty wood, but soft. It cuts clean, and is adapted for many kinds of work, which, however, must not be delicate in design.

It has the same grain as Black Walnut, stains well, and shows oiling to advantage.

Strength and Breaking Strain.

The most important qualities of building material necessary to consider are its strength and breaking strain or breaking weight, and the amount of pressure which can be safely laid upon it in accordance with its form, thickness, position, etc. It has been ascertained by actual experiments that the strength of a beam or girder of timber, and hence of any piece of timber, whether large or small, increases directly as the width, and as the square of the depth. Thus, if a piece of wood measuring three inches in breadth and three inches in depth—that is to say, nine inches square in section—will bear a certain weight, a beam six inches broad and three inches deep will bear *twice* the weight; but a beam three inches broad and six inches deep will bear *four* times the weight. The strength is also inversely as the length. If two beams of equal breadth and depth be taken, but one of them be twice as long as the other, the longer beam will only bear half the breaking weight that the shorter one will sustain, or, in other words, will be only half as strong.

It will now be clear why, in laying joists to sustain a floor, the timbers are so placed as to have considerable depth from top to bottom, while the breadth is comparatively narrow.

A continued strain tends to weaken the power of resistance in a beam, and the power will be lessened still more when the weight is variable, or is a rolling instead of a dead weight. The nature of the wood must also be taken into account: thus, some in which the fibre is long and the grain straight will bend to a very great degree, while others in which the grain is short and close will scarcely bend at all, but break suddenly. In framing timber, as the carpenter is called upon to do, all these points must be taken into consideration.

The instantaneous breaking weight of any kind of wood is the weight under which it will give way and break when loaded with the weight in the centre. It has been said that the load with which a beam may be weighted without risk should never exceed more than *one-third* of the breaking weight; but it is better and safer never to let the load exceed *one-fourth* of the breaking weight. Indeed, it is argued that timber is permanently injured if more than this is applied to it. The best authorities on carpentry say that a load cannot be looked on as safe if it exceeds *one-fifth* part of the breaking weight.

It is by no means a difficult thing to find the breaking weight of every piece of timber, and, this being known, the load that it will sustain without injury; this as it has just been shown, estimated by different authorities at from one-fifth to one-third of the breaking weight. The following is a general rule for finding the breaking weight in the middle for girders of wood supported at both ends:

RULE.—*Multiply the breadth in inches by the square of the depth in inches, and divide by the length of bearing in feet. The result obtained, when multiplied by a certain constant or invariable quantity, for the kind of timber under consideration, gives the breaking weight in the centre in hundredweights.*

This constant or invariable quantity, which has been determined by a series of experiments, is stated by Barlow to be: For Ash, 6; for Oak, 5; for Pitch Pine, 5; for Red Pine, 4; for White Pine, 3.

TOOLS USED IN CARPENTRY

An able author and artisan, describes the tools used in carpentry in groups as follows, namely, "Striking tools, saws, cutting tools, planes, boring tools, pincers, guides, and auxiliary appliances." It seems possible, however, to render the classification more complete by the following arrangement:

I. STRIKING TOOLS.
  1. *Tools that are used for striking only, as Hammers and Mallets.*
  2. *Tools that are used for striking and cutting, as Hatchets, Axes, Adzes, etc.*

II. RASPING TOOLS, OR TOOLS THAT ACT BY ABRASION.
  1. *Saws of all kinds, for cutting wood.*

  2. *Rasps and Files, for smoothing, shaping, cutting, etc.*

III. PARING TOOLS OF ALL KINDS.
  1. *Planes of various kinds, for smoothing, moulding, etc.*
  2. *Spokeshaves and Drawing-knives.*
  3. *Chisels and Gouges*

IV. BORING TOOLS.
  1. *Bradawls, Gimlets, and Augers.*
  2. *Brace and Bit, sometimes called Stock and Bit.*

V. HOLDING OR GRASPING TOOLS.
  1. *Pincers and Pliers, Nippers, Spanners, and Wrenches.*
  2. *The Vice, including Hand-vice, Bench-Vice, etc.*

VI. TOOLS OF GUIDANCE AND DIRECTION.
  1. *The Carpenter's Rule and Chalk Line.*
  2. *The Square, Bevel, Gauge, Mortising-Gauge, Mitre-Box.*
  3. *Spirit Level, Straight Edge, Plumb and Level.*
  4. *Compasses and Callipers.*

VII. MISCELLANEOUS TOOLS NOT SUBJECT TO CLASSIFICATION.
  1. *Screwdriver, Nail-punch, Scriber, Rymer or Reamer, etc.*

Striking Tools.

Of hammers, the amateur should possess three—namely, an ordinary joiner's hammer for heavy work, a lighter one of the same form for medium work, and a light hammer with a small face, usually known as a "ladies' hammer," for driving brads and small fine nails into small light work. If he determines to do any veneering, there is a special kind of hammer used for this purpose which must be obtained.

Many other kinds of hammers are used for various kinds of work, but those named will be sufficient for the amateur's purpose.

In striking a tool with a wooden handle, as a chisel, the wooden mallet, not the hammer, should be used, a convenient size having a head 6 inches long and 2½ by 3½ inches wide in face. The amateur must remember that tools of a medium size are always likely to be most useful to him.

The tools that are used for cutting as well as striking, whose blow severs or splits as well as drives forward, are the adze and axe, or hatchet. The adze is not likely to be required by the amateur; it is used chiefly by shipwrights in ship building, and sometimes by the carpenter. It is with the AXE or HATCHET that the amateur artisan is more immediately concerned, and this is a tool that he cannot do without, for it may be made useful in a variety of ways. In framing timber together it can be used as a hammer, instead of the heavy carpenter's hammer, which the amateur need not place among his tools; and for sharpening stakes or cutting down timber to the size required in the rough, or for splitting pieces of wood, it is invaluable. It should be kept well sharpened, for a blunt axe is useless for any purpose, so far as cutting is concerned, except splitting firewood.

Rasping Tools.

RASPING TOOLS are those which act by abrasion or rubbing away the material to which they are applied.

There are many kinds of saws in use, but those which the amateur artisan will most require are the HAND SAW, TENON SAW, DOVETAIL SAW, KEYHOLE SAW, and FRAME SAW. These are sufficient for all ordinary work. To these, in order to save wear and tear of the hand saw, a saw called a rip, or ripping, saw may be added. This saw has large, triangular teeth, and is used for sawing along the grain. It is therefore useful for sawing planks, battens, and boards the way of the grain; the work being done more expeditiously with a rip saw than a hand saw.

The HAND SAW is generally useful, and will serve the purpose of a rip saw or a panel saw, a finer kind of saw used by joiners.

The TENON SAW is used more especially for cutting across the grain of the wood, and leaves the surface of the wood that is divided by it as smooth as is possible when the nature of the operation is considered. The blade is of necessity thin and fine, and, in order to keep it straight when in use, it is inserted into a back of iron or brass. It is worked by means of a handle differing in form from that of the hand saw. A tenon saw to be really useful should be from 14 to 18 inches in length.

The DOVETAIL SAW and the SASH SAW are nothing more than tenon saws of small size, being identical with these in shape and make. They range from 8 to 12 inches in length.

The KEYHOLE SAW consists of a long narrow movable blade. The handle is pierced throughout with a narrow slit sufficiently large to allow of the easy passage of the saw. It is useful for cutting out curved work, while rough coarse fretwork may be done with it, and perforated work for rough carving.

RASPS, generally speaking, are used in carpentry for cutting away or smoothing wood, or for wearing away the sharp edge left in a circular hole that has been cut out with the keyhole saw, so as to impart a bevel to it sloping from above to the under part. A rasp is flat on one side and slightly convex on the other, and is covered with fine projecting points beaten up by a mallet and punch. They are of different degrees of roughness.

The FILE, whose ridges are finer than those of the rasp, is used for cutting metal and sharpening saws.

Paring Tools.

PARING TOOLS, or tools which are used for cleaning away the rough, ragged surface left by the teeth of the saw and rendering wood smooth and even, or otherwise for cutting wood into various forms and shapes, are frequently called *edge tools*, as they present a sharp, keen edge. Indeed, if they are blunt in the least degree they are not fit for use. Watch an artisan at his work, and you will see him frequently rub his plane-iron or chisel on the oil-stone in order to sharpen it. An amateur, especially a beginner, in nine cases out of ten either does not think of doing so, or altogether forgets that there is any necessity for it, and this is one of the chief reasons why amateur's work is often so badly done.

It is important for the amateur to buy none but good tools, and to keep them under lock and key. He must supplement this by keeping them clean and free from rust, and learning to whet the edges of all cutting tools when they show signs of dullness.

The tools that are comprised in the first group of paring tools are Planes. Of these there is a great variety, as formerly, before molding was made by machinery, every different pattern required a different plane or plane-iron. The planes that are most necessary to an amateur are a jack-plane and a smoothing-plane.

The JACK-PLANE is from 15 to 18 inches long and 2½ inches broad, and about the same in depth. Near one end is a handle projecting upwards, and near the other a hole for the reception of the plane-iron, which is held in its place by a wedge. Planes of this description, and smoothing-planes also, are usually made with double irons; that is to say, with two irons held together by a short screw.

The SMOOTHING-PLANE is different from the jack-plane in shape, being about 8 inches long and 2½ inches to 3 inches broad, in the widest part where the iron issues from the wood, tapering to a width of about 2 inches in front and 1¾ inches behind, so that it may be more easily held in the hand. The jack-plane is used for taking the rough surface from the sawn timber, and when this has been removed the smoothing-plane is used to make the surface of the wood perfectly smooth and even.

The SPOKESHAVE and the DRAWING-KNIFE are the tools that are comprised in the second division of paring tools. The drawing-knife is useful for reducing the size of any piece of wood that it may be inconvenient to cut down in any other way. The spokeshave, as its name implies, may be used for imparting a smooth surface to the spokes of wheels, but it is also useful for smoothing down any surface that is not required to be perfectly flat. Thus, a beveled edge may be given to a round hole of any large size cut in a piece of wood. The drawing-knife is always worked towards the operator, but the spokeshave may be used in a direction either towards or from the person who is using it.

The third and last division of paring tools comprises CHISELS and GOUGES. In reality the plane in its simplest form, as seen in the jack-plane and smoothing-plane, is nothing more than a chisel of considerable width set in a block of wood, which serves as a guide, and by means of which the operator is enabled to work the tool with greater ease and accuracy. A chisel is a flat and thick piece of steel, of which the cutting end is ground to a bevel, in order to obtain a keen edge, while the other is fashioned into a tang, with a projecting shoulder, which fits close against the wooden handle into which the tang is inserted. The gouge differs from the chisel in being hollow instead of flat. Chisels are distinguished as firmer chisels, paring chisels, mortising chisels, and turning chisels. It must be said, however, that the last-named variety differs from the other kinds of chisels in being ground to a bevel on both sides instead of one side only.

It may be mentioned that the tool called a *cold chisel* is a long piece of steel, beveled on both sides at one end to a blunt edge, used by carpenters and others to knock out a hole in a wall of stone or brick for the insertion of a wedge, the end of a piece of timber, etc.

About half-a-dozen chisels and the same number of gouges will be the utmost number that the amateur will require; and, for both chisels and gouges, the widths to be selected may be placed at ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., and 1½ in. The ordinary carpenter's chisels should be purchased first of all. A few paring chisels can be added to the stock at any time if required.

Boring Tools.

The tools comprised in the first division of *boring tools* are bradawls, gimlets, and augers. These tools are, for the most part, extremely simple in construction, the bradawl being a piece of steel sharpened at the end and fixed for convenience of use in a wooden handle; and the gimlet a piece of steel so fashioned at one end that it may take hold of, and cut its way into, timber, and having a small piece of wood or iron attached crosswise at the other end, which serves as a lever to turn the steel shank of the tool, and press it into the wood. The auger is only a gimlet on a large scale, the cross handle being turned by the operator with both hands, which are transferred from end to end of the handle at every half-turn of the tool.

The BIT-BRACE or STOCK-AND-BIT, is the principal boring tool, and, indeed, the only tool of this kind with which the amateur artisan need concern himself. There are breast-drills, fitted with a plate to hold against the breast, steadied with a handle held in the left hand, and having a chuck at the further extremity, in which the drill is placed and caused to revolve at a rapid rate by a large toothed-wheel working in a smaller wheel, the former being turned by a handle held in the right hand.

Other Tools.

In good carpentry everything depends on accuracy of measurement of parts, and fitting the parts together at right angles, or at the required angle or bevel. For the attainment of these most necessary requisites, *tools of guidance and direction* of various kinds are used, without which it would be impossible even for a skilled carpenter or joiner to do his work, and fit the various pieces together with the nicety that is essential in all operations of this nature. Thus, for setting out a long, straight line in ripping a slip of wood from a board, a *line and reel* is required; and for the measurement of any length into parts, or to measure any required length, breadth, and thickness, the *carpenter's rule* is needful. For cutting off the end of a board at right angles to the edge, or for mortising, etc., the *square* must be used, and for cutting wood at any given angle to the edge, the proper line of direction for the saw must be marked by aid of the *bevel*. For cutting notches in wood, or for cutting or planing down pieces of wood to the same thickness, the necessary guide lines must be marked by a *marking gauge*, while in mortising the *mortise gauge* is used.

For joining pieces of wood at right angles, as in making a picture-frame, recourse must be had to the *mitre box;* and for subdividing any given space into smaller spaces, or marking out circles and sweeps of various diameters, the *compasses* must be used. In turning, to make sure of having the diameter of various parts of the work in harmony with the pattern, these diameters must one and all be tried and regulated by the *callipers* as the work goes on. In bringing horizontal bars, shelves, etc., to a true level, the *spirit level* must be used; and in fixing a post in the ground, or a piece of quartering to the wall, the *upright level* with cord and plumb-bob. A *straight-edge* is useful for testing the nicety and accuracy with which wood has been planed up, and for other purposes. We name these, though the amateur is not likely to need them all. There are many miscellaneous tools and appliances used in carpentry and joinery which are not subject to classification. Among these we may include the screw-driver, the nail-punch, the reamer or rymer, the scribe, the cramp, the glue-pot, and the oil-can. Sand-paper and emery-paper must also be noticed. There is another appliance called the bench holdfast, which is used to hold wood firmly down on the carpenter's bench when necessary.

These tools are so simple and easily obtained that a description of each is not necessary. In there selection *cheapness* is not to be considered, but accuracy and convenience.

The Glue-Pot.

The GLUE-POT should be in every house, whether the tenant turns his attention to household carpentry or not. So many little odd jobs can be done by its aid, that, if nothing more than a hammer and screw-driver be kept, a glue-pot should be purchased. For example, a piece of veneer may come off a looking-glass frame, or any piece of furniture, and may be mislaid or lost before a carpenter happens to be at work in the house, putting these and similar little matters in order. Now, if the piece of veneer is lost it will be a costly business—that is to say, costly in proportion to the actual damage—to replace it, and if the missing piece is not replaced the appearance of the piece of furniture is spoiled, and its value considerably deteriorated. But, if a glue-pot is at hand, the damage may be instantly repaired, and if the mending is carefully done, as it ought to be, the piece of furniture is little the worse for the mishap.

The glue-pot is a pot within a pot, the outer and larger one being of iron, and the smaller one of copper or iron, as the case may be. The glue is broken up small, and placed in the smaller pot, which fits into the larger pot, the rim of the former resting on the rim of the latter. Water is placed in the larger pot, sufficient to nearly fill it when the smaller pot is put in. The pot is placed on or close to the fire, and as soon as the water boils the glue begins to melt, until it is reduced to a semi-fluid condition.

Recipe for Making Glue.

The following is a good recipe for making, or, rather melting, glue. It is given by an authority in "Workshop Receipts:" "Break the glue into small pieces, and soak from twelve to twenty-four hours in cold water; put the glue in the glue-pot, fill the outer vessel with water, and apply heat. For ordinary purposes it should run freely, and be of the consistency of thin treacle. The hotter glue is, the more force it will exert in keeping the two parts glued together; in all large and long joints the glue should be applied immediately after boiling. Glue loses much of its strength by being often melted; that glue, therefore, which is newly made is preferable to that which has been used. When done with, add some of the boiling water from the outer vessel to the glue, so as to make it too thin for immediate use. Put it away till wanted again, and by the time the water in the outer vessel is boiled the glue in the inner is ready melted and of the proper thickness for use. Powdered chalk, brickdust, or sawdust, added to glue, will make it hold with more than ordinary firmness."

To do any kind of work in carpentry and joinery, with blunted tools, in a creditable and workman-like manner is simply impossible. The professional carpenter and joiner will frequently stop in his work to put his plane-iron and chisel on the oil-stone—for he is well aware of the importance of having a keen edge to all cutting tools of this description—and he will take care to keep his saws sharpened and fit for use. It is necessary that the amateur artisan should imitate the regular mechanic in this essential duty of keeping his tools in a fit condition to do the work that is required of them.

Directions for Sharpening Tools.

Of course all *cutting tools* must be provided with a keen edge, and this is obtained by grinding them to a proper bevel on the grindstone and afterwards rubbing them on the oil-stone. Among *striking tools* the adze and hatchet will require sharpening on the grindstone.

For sharpening or rather for grinding edge tools such as plane irons and chisels, the grindstone is also necessary, finishing off on an oil-stone. It is necessary that the cutting edge should be made as straight and true as possible.

The following directions are for grinding edge tools, which the amateur will do well to follow implicitly, as it is given by a practical workman of great experience. "In grinding plane irons, chisels, and similar tools, *the stone should turn towards the operator*, and the tool should be held very firmly and quite squarely upon the stone, at a point sufficiently near its upper part to allow the tool to be in a nearly horizontal position, while its bevel lies flat upon it. If it is held too low, so that its handle points downwards, the water from the stone will run down the hands and arms, which is decidedly disagreeable, especially in winter." In addition the tool cannot be so firmly held nor the work so readily seen. Keep the edges of the stone in use by constantly traversing the tool across its face, and never try to hurry the work by grinding to a more obtuse bevel than that made by the manufacturer. This is, indeed, generally rather more obtuse than it ought to be, and carpenters reduce this angle, and then the second bevel, formed by the oil-stone, restores it correctly. In grinding planes and chisels, especially the first, it is as well for the amateur to make use of a square to test the correctness of the edge, otherwise the latter may not be truly at right angles to the side of the tool.

The Carpenter's Bench.

One of the most indispensable essentials to the performance of operations in carpentry and joinery is the carpenter's bench. Nothing can be fairly done without it—except sawing, for which the stool is wanted; or mortising, which may also be done on a couple of stools or trestles, although small mortises may be cut on the bench. Planing must be done entirely on the bench, the surface of a board being laid flat on the top of the bench and butted against the bench-stop. In planing the edges, the board must be laid along the side of the bench, being supported on pegs (for the reception of which holes are made along the side itself) in the middle, and at one end nearest the operator, while it is gripped and held tightly against the side by the bench-jaw or vice at the other end.

How to Hold and Handle Tools.

Having provided oneself with the necessary tools and work bench, or such a selection from the whole as may best meet his requirements, the next thing to be done is to learn how to use them. It is next to impossible to do this from printed instructions; and on the principle that a little showing is better than a great deal of telling, the best advice that can be given to the amateur on this head is that he should arrange with some skilled artisan to give him a few practical lessons in the method of holding, using, managing, and sharpening his tools, and the everyday operations in carpentry and joinery, such as sawing, planing, scarfing timbers, cutting rebates, mortises and tenons, dove-tailing, mitring, etc., etc.

THE DIVISIONS OF THE BUILDING TRADE

When any art or manufacture begins to assume importance, and there is a continually increasing demand for the articles, be they what they may, that are made by those who are engaged in it, it has been invariably found that in due proportion to its growth the art or manufacture, as the case may be, becomes divided and even subdivided into many and various branches, until it is well-nigh impossible to carry the subdivision of the trade to a greater extent.

The building trade is an aggregation of various trades and their separate departments, which have become affiliated, as it were, and grouped together for the better attainment of the end desired.

Taking each a prominent and active part in the building trade we find the excavator, bricklayer, mason, pavior, slater, plasterer, carpenter and joiner, sawyer, ironmonger, smith and founder, zinc-worker, wire-worker, bell-hanger, gas-fitter, plumber, painter, decorator, gilder, paper-hanger and glazier—a goodly array of tradesmen and artisans whose aid and co-operation is absolutely necessary in building and finishing a house.

Practical Knowledge of all the Trades.

It is in doing repairs of an ordinary nature that the amateur will find practical knowledge of the arts connected with the building trades of use to him, in the first place. Secondly, he will find it of equal value in constructing any small building for use or ornament, or for both, out of doors, or for making any appliance within doors; and thirdly, as it has been already urged, he will find it of even more value in enabling him to look after men who may be at work on his premises, and in seeing that the work is done in a proper manner.

Excavations of all kinds can easily be compassed by the amateur, and he will find no difficulty whatever in making and using concrete. In connection with this kind of work lies the making of walls and paths of all kinds, and no one will deny that it is of advantage to the amateur to know how to do these things. In building walls with brick and stone he will probably fail, and more particularly because it is by no means as easily done as other kinds of work that fall more naturally within his compass; but, at the same time, it is desirable to know how to repair and "point" a piece of garden wall, as it is technically called; to fix a step that has become loose with cement; to put a piece of paving to rights and relay a loose paving-stone; and to repair a piece of plastering that has been displaced by damp or other causes.

Work in Metals.

Similarly he may not be able to accomplish much in smiths' work, but it is certainly of advantage to be able to work in iron so far as to be able, by aid of fire, hammer, and anvil, to beat a piece of iron into any shape that may be required, to drill a hole, and to turn a screw, which operations come under the category of forging. Casting, which necessitates the melting of metal in a furnace and running it into a mold, is an operation which may well be left to the iron-founder; but it is useful to possess an iron ladle, and run in lead round an iron bar or rail that has been loosened in the socket cut for it in a stone coping or step.

Zinc-working, as far as making a simple shoot and covering a small flat roof are concerned, and wire-working in the construction of a wire trellis, hanging basket, sieve for sifting earth or cinders, or repairing such articles, are far more practicable; and soldering and simple working in sheet metal are matters with which the amateur may readily make himself acquainted. Plumbing and gas-fitting, which if badly and inefficiently done may involve serious consequences, are best left to professional artisans; but it is as well to know how to stop a leak in a pipe on an emergency, how to take down a gasalier, clean it, and put it in its place again, and how to substitute new gas-burners for old ones with safety.

Decorative Work.

In the decorative portions of the building trade he will find no very great difficulty. House-painting—that is to say, covering wood or metal with a uniform surface of oil paint—may be easily managed, and to a person possessed of taste and manual skill the work done by the decorator will present no very great difficulty. Paper-hanging requires nothing more than care and a certain amount of manual dexterity. Glazing is more easily done than most of the work that has been mentioned, but as it involves handling putty it is not, perhaps, very desirable work. Still, it is work that should be taken up and carried out by the amateur, as he can put in a pane of glass for about half the price at which a professional glazier will do it if the work be such as can be done at the shop, as the glazing of a light for a pit-frame, etc., and for from one-sixth to one-fourth the price charged if it be a window.

Practical Points in Excavating.

The following facts with regard to excavator's work, may be of use: "In loose ground a man can throw up about 10 cubic yards per day, but in hard or gravelly soils 5 yards will be a fair day's work. Three men will remove 30 yards of earth a distance of 20 yards in a day. A yard (cubic) of concrete requires about 3 hours' labor to mix and throw in, or if in heavy masses, and the materials handy, about 2 hours. With regard to the weight of materials, 19 cubic feet of sand, 18 ditto clay, 24 ditto earth, 15½ ditto lime, 20 ditto gravel, will each weigh one ton. A cubic yard of earth before digging will occupy about 1½ cubic yards when dug. Sand and gravel does not increase more than one-third as much as earth in bulk when dug, but will decrease in height one-fourth more than earth. A wheelbarrow (that is to say the broad, shallow barrow used by navvies) holds $\frac{1}{10}$ yard cube. A cubic yard, or 27 cubic feet of earth, is a single load, and contains 20 bushels; 1 cubic yard of gravel contains 18 bushels in the pit; when dug it will increase nearly one-third in bulk, but will subside nearly one-fourth in height, and decrease one-fifth in bulk when formed into embankments. When earth is well drained it will stand in embankment about 1½ to 1."

This will prove a useful rule for the amateur in throwing up embankments, mounds, etc., in his grounds or garden. If revetted, to use an engineer's term, or covered with turf, the inclination may be greater, because the roots of the grass bind the surface earth together and keep it from being washed down by heavy rains. This will be evident from an inspection of the side of a hedge or bank covered with turf which may be inclined to the horizontal base line at angles ranging from 10° to 20°.

Making Good Concrete.

Concrete, now so much used in forming the foundations of buildings of every description, and even the walls themselves, is a mixture of cement and sand, gravel, broken stones, brick rubbish, or similiar materials in the proportion of one part of cement to five or six parts of any of the other ingredients that are used in its manufacture. Good lime is often used instead of cement, but the amateur, if he uses lime at all, is advised to use cement with it in equal parts. The cement, being the substance that binds the gravel ballast, etc., together into a solid mass impervious to water, is technically called the *matrix*, and the substance that is added to the lime is called the *aggregate*.

It may be said that any waste material of a hard nature may be used as aggregate in making concrete, sand and gravel of all kinds, including pea or fine gravel, pit gravel, river gravel, ashes, cinders, and coke, lime chippings, flints, old stones and bricks, especially when broken, broken earthenware and stoneware, and rubbish from the brickyard may all be used. Slag, too, the refuse of the iron furnaces, can be made available whenever it can be obtained. It should not be used in too large sizes. Pieces about the size of stones ordinarily used for mending roads, or such as will pass through a ring of 2½ inches in diameter, are best suited for the purpose when the material is broken up on purpose for making concrete.

Any of the various cements in general use may be used in the manufacture of concrete, but the amateur is recommended in all cases to use Portland cement.

Quantities of Cement Used.

When made into stucco for covering a wall, the following table will show the extent of surface that a bushel of cement may be made to cover when used pure or with various proportions of sand, and at certain thicknesses:

1 bushel of cement will cover 1⅛ yards 1 inch thick, 1½ yards ¾ inch thick, 2¼ yards ½ inch thick; 1 bushel of cement and 1 of sand, 2¼ yards 1 inch thick, 3

yards ¾ inch thick, 4½ yards ½ inch thick; 1 bushel of cement and 3 of sand, 3½ yards 1 inch thick, 4½ yards ¾ inch thick, 6¾ yards ½ inch thick.

As cement will not keep, especially in a moist atmosphere, the amateur, when he requires a small quantity for repairs, is recommended to buy just so much as he wants and no more.

In making concrete, it is important, in the first place, that the aggregate, be it what it may, should be deposited on a clean place—if on old boards, as scaffold boards, so much the better—so that no dirt may get mixed up with it. The concrete itself should be made on boards, nailed together on ledges or on three putlogs placed on the ground parallel to one another, forming a rough platform. The aggregate and the cement or lime used as the matrix must then be placed on the boards, the aggregate being measured out first, and the proper proportion of concrete to the aggregate being also measured out and thrown upon it. The heap is then wetted with water poured over it from a large water-pot fitted with a fine rose, and the whole is then mixed until the materials are thoroughly amalgamated.

Bricklaying.

BRICKLAYING is in itself an apparently simple process, inasmuch as it consists merely in laying or disposing regular and similar rectangular pieces of baked clay one upon another, layer upon layer, until a certain height is reached, spreading a composition of lime and sand called mortar between each layer, which hardens and connects the bricks together in a tolerably solid mass. There is, however, much more skill in bricklaying than is apparent at first sight, and really good bricklaying cannot be done without practice any more than other building processes.

The tools requisite in bricklaying are a large, strong steel trowel, with which mortar may be spread and bricks chopped asunder or reduced to any extent that may be required in order to produce a perfect bond. Mortar is carried up the ladder, and on to the part of the scaffolding where the bricklayer is at work, by his attendant laborer, in a vessel called a hod, which is shaped like a box, open at one end and cut across diagonally, and fitted at the bottom angle into a short pole. Then a small trowel for pointing, and a mortar-board to hold in the hand, on which the mortar or cement is carried.

A brick is accounted to be 9 inches long, 4½ inches broad, and 2½ inches thick, the breadth being half the length, and the thickness rather more than half the breadth, or one-fourth the length; an arrangement which renders bricks more convenient to use, owing to the correspondence and harmony of proportions in length, breadth, and thickness. The equivalents of the thicknesses of walls enumerated in terms of bricks will, therefore, be, when expressed in inches, ½ brick = 4½ in.; 1 brick = 9 in.; 1½ bricks = 13½ in.; 2 bricks = 18 in.; 2½ bricks = 22½ in., etc. There are many different kinds of bricks, embracing the three classes of building bricks, fire-bricks, and clinkers, or paving bricks.

Mortar for Brickwork.

Bricks are cemented together with mortar, which is a mixture of lime and sand brought to a pasty consistence by the addition of water. When it is desired to make brickwork as strong and durable as possible, the mortar should be made of cement, or a little cement should be added to the lime. The following are the proportions:

Lime and sand, and cement and sand, lose about one-third their bulk when made into mortar, and lime and Portland cement both require one-third their bulk of water to mix. For a rod of brickwork (containing 306 cubic feet and needing 4,352 bricks), 71 cubic feet of mortar will be required, and to make this quantity are required 1½ cubic yards of unslaked lime and 3 of sand; or 1 cubic yard of stone lime and 3½ of sand; or 36 bushels of cement, and the same quantity of sharp sand. Lime or cement and sand, to make mortar, require as much water as is equal to one-third of their bulk, or about 5½ barrels for a rod of brickwork built with mortar.

The mortar used by the old builders was far more durable than the mortar used in the present day. It hardened into a mass which offered greater resistance to the weather than even the stone itself that it was used to cement together.

The cost of brickwork may be easily calculated from the above memoranda.

Soldering and Brazing.

For zinc-working, plumbing, gasfitting, and all kinds of work in sheet metal, a knowledge of the processes termed soldering and brazing is necessary. By these processes the edges of pieces of sheet metal are joined together, and although it is better for the amateur, for safety's sake, to have all zinc-working that he may require in the way of covering roofs, making zinc pipes, lining wooden cisterns, and similar operations, done by the professional zinc-worker, and to call in the plumber and gasfitter to rectify any leakage in lead pipes or gasfittings, it is as well that he should know how to make a joint in metal, whether sheet or pipe, and possess the few appliances necessary for doing so. If he can do no more than repair tin pots, kettles, etc., it will be of advantage to him, for the itinerant tinman seldom does his work effectually, and seems never to be at hand when his services are most required.

First, then, with regard to soldering and brazing. They may both be described as methods of uniting pieces of either the same or different kinds of metal with a strong and, if necessary, water-tight joint.

To effect this by the first-named operation, namely *soldering*, a compound metal called solder is used. This composition is melted, but the metals to be united do not require to be heated otherwise than through contact with the melted solder.

In the operation of *brazing* the metals to be joined must be raised to the melting point of the brazing composition, which is soft brass. Although this makes the strongest joint, the necessity for exposing the articles to such a great heat renders this operation inapplicable to many purposes.

Soldering is very useful for joining copper and copper, copper and brass, copper and iron, brass and brass, brass and iron, tin and tin, and tin and any other metal. If the joint has to stand a rather high degree of heat—such, for instance, as the seams of a small copper steam boiler—a *hard* solder must be used. By hard solder is meant one that only fuses at a high temperature; a *soft* solder, on the contrary, fuses at a low degree of heat.

The following are the compositions of some of the most useful of solders and alloys, with the degree of heat required to melt each:

Tin.	Lead.	Bismuth.	Mercury.	Melts at
1 part	25 parts	. . .	. . .	558° Fahr
2 "	1 "	. . .	. . .	340° "
2 "	2 "	1 part	. . .	292° "
5 "	3 "	3 "	. . .	202° "
5 "	3 "	3 "	3 parts	122° "

How Soldering is Done.

The surfaces to be united must be thoroughly cleaned and brightened. Without this the metal will not adhere. The soldering iron must be warmed sufficiently to melt the solder; it must not be made red-hot, because the solder will not "hold to it."

Whilst the iron is warming, *tin* the surfaces by brushing them over with muriatic acid, dipping them into melted solder, and quickly rubbing off the adherent metal. This, if done well, will leave a thin coat of solder. When it cannot be done thus, the surfaces must be tinned by means of the soldering iron. In this case they must be coated or washed with the acid as before, but the solder must be melted on the places required with the hot iron.

When tinned, the surfaces should be brought close together, a little acid rubbed along the joints, and the iron dipped in the acid and put against some solder, so that the melted solder will stick to the iron. The iron must now be applied to the joints, and drawn slowly along in such a manner that the metal between the joints is melted, and the joints filled up. A little practice will soon make the amateur tolerably skilful in doing this. The muriatic acid, or spirit of salt, as it is sometimes called, must be *killed*, or rendered neutral, before it is used, and this is done by putting one or two small pieces of zinc into it and allowing it to expend all its energy on this. Killed acid is much more effective than the raw or pure acid. Sometimes resin is used instead of the acid; but the neutralized acid is preferable, because it does not leave the work in such a mess as resin.

Should it be desirable for the solder not to adhere to any portion of the article, a paste must be made with whiting and water, and put about those places; this paste will harden with the heat, but can be removed after the soldering operation is effected.

Indoor and Outdoor Painting.

Nearly all that has been said with regard to operations in the building trades is connected with construction, but here we shall speak chiefly of decoration. It has long been found necessary to protect wood and iron from the ill effects of moisture by a hard exterior coating impervious to wet; and hitherto the best preservatives have been found to be paint and varnish, through which no wet can penetrate as long as they remain in a sound state.

In doing work of this kind, it is much better and cheaper to buy paints and varnishes ready mixed. One very good reason why the amateur painter should do this is that the paint which he makes himself is apt to take a long time to get thoroughly dry and hard; and sometimes, even after the lapse of several weeks, it is still sticky.

Before beginning to paint, all dirt and projections, such as lumps of glue, etc., must be cleared away with the putty-knife and duster. Then, if the work be new, all the knots in the wood must be killed with *knotting*, to prevent the turpentine in the knots from oozing out and spoiling the appearance of the painting when finished. Knotting is a preparation of red lead, litharge, boiled oil, and a little turpentine; the amateur is advised to buy the "patent knotting," which may be obtained ready for use. After the knotting, which dries and hardens very quickly, is applied, the *priming*, or first coat, is put on. This is made of white lead, with some drying material, and a little red lead to harden it. It is made very thin with oil, as unpainted wood or plaster absorbs the paint very quickly.

The Several Coats of Paint.

As soon as the priming is dry, all holes made by punching in the heads of nails, cracks, etc., must be stopped with putty. It is useless to attempt to do this before the priming has been applied, because putty will not stick to wood unless painted. After this has been done the *second coat* may be applied; and for new work the second coat of color should be made up chiefly of oil, because oil is the most efficient in stopping the suction of the wood; then a *third*, and even a *fourth coat*, may be applied. In laying on the color, the brush should be passed backwards and forwards and in every direction, to spread the color evenly and work it well into the wood, in the earlier coats.

Finally, the brush should be drawn up and down, or backwards and forwards, as the case may be, in the direction of the grain of the wood, taking care to leave no marks of the hairs of the brush. In painting a door, or any piece of work in which part is sunk and part raised, the mouldings or any bead-work should be painted first with a sash tool, and then the panels, styles, and rails with a brush. No coat should be laid on a previous coat until that coat shall be perfectly dry and hard; and before beginning to paint any piece of work, whatever may be the number of the coat, every particle of dust that may have settled on it should be carefully removed with the dusting brush.

The composition of the paint that is applied to old work, and indeed to wood generally, must depend upon the style or manner in which the work is to be finished. The first coat after the priming in new work should be paint in which the oil predominates over the turpentine: but for the first coat for old work the turpentine should be in excess of the oil. Paint mixed with oil in excess will present a shining surface when dry, but paint mixed with turpentine in excess will present a flat, dead, dull appearance. Therefore, when a shining surface is required, it is necessary that the under coat should be paint mixed with turpentine, the final coat being mixed with oil; but when the finishing coat is to be "flatting," as it is technically called, it must be laid over an under coat or ground color mixed with oil.

Removing Old Paint.

When the surface of a coat of paint, that is to say, of any under coat, appears rough, especially in the case of patches in old work that have been retouched, the paint, when dry, should be rubbed down with fine glass paper until the roughness has disappeared. All loose paint, or paint that appears loose round the blister-marks, should be scraped away with a knife before the putty is put on. For cleaning old greasy smoke-stained paint limewash or limewater may be used. This kills the smoke or grease, on which no oil paint will ever dry and harden. Some will put a coating of weak size over the smoke and grease; the paint will dry on this, but it is very likely that it will soon crack and peel off.

It is not desirable to keep loading on coat after coat of paint on old work. It is better, when the incrustation caused by successive coats of paint has become very thick, to remove the paint entirely and begin *de novo*. There are various modes of removing paint. The professional painter will do it by the agency of heat, applying a flame to the surface of the paint; the heat soon softens the color, and it may then be scraped away with a knife.

Other Modes of Removing Old Paints.

RECIPE.—*To Remove Old Paint from Woodwork.* (1) Make a very strong solution of common washing soda, and apply it to the paint with a brush until the paint can be scraped away. (2) Apply naphtha to the paint in the same manner, giving it a second and even third damping with this substance until the paint yields. When soft enough scrape it away with a knife. (3) Slake 3 lbs. of stone lime in water, and then add to this 1 lb. of pearlash, and sufficient water to bring the whole to the consistency of thick cream. Apply the preparation with a brush, and leave it on the paint for from eighteen to twenty-four hours, when it will be found that the paint is softened and may be easily scraped off.

The amateur will find it necessary, perhaps, to do his painting work at intervals, often few and far between. If he leaves paint in the paint pot for some length of time, he will discover, much to his annoyance, on resuming work, that the paint is too hard and thick to be used. The addition of some oil and turpentine may save a little of it, but it will neither work pleasantly, nor, indeed, be worth using. Whenever paint must be put aside, a little cold water must be poured on the top of the paint. This prevents the evaporation of the oil, and keeps the paint all right for future use by excluding the air and preventing its action in drying and hardening the paint.

The Care of Brushes.

Similarly, brushes not in use should have the bristles or hair kept under water, that they may remain soft and flexible. It is better, however, when the amateur painter does not know how long it may be before he uses his brush again, to wash the color well out of it by means of a little turpentine, and then allow the brush to dry. When kept in water for some time, the constant soaking will rot the string and the bottom of the wooden handle to which the bristles are attached, and the amateur, on commencing painting, will experience the annoyance of his brush snapping off short like the end of a carrot.

Various Coloring Substances Used in Painting.

It will be useful to the amateur painter to mention the various pigments or coloring substances used in painting to produce different simple colors, and to follow these with a list of colors that are produced by combinations of two or more of these colors. White lead, a substance highly prejudicial to the health, both of those who manufacture it and those who use it, is mixed with all colors to tone them down and produce different shades, hues, and tints. There are, however, other mineral whites capable of supplying the place of white lead, which have the advantage of being non-poisonous pigments.

It will be convenient to classify each set of coloring substances, whether mineral or otherwise, under the color which it yields when properly mixed.

Table of Simple Coloring Substances.

(1) *Whites.*—White lead, including Ceruse and Flake White, Zinc White (oxide of zinc), Griffith's Zinc White (oxy-sulphide of zinc—non-poisonous), Spanish White.

(2) *Blacks.*—Lamp Black, Ivory Black, Blue Black, Vegetable Black, Patent Black.

(3) *Yellows.*—Chrome Yellow, Turner's or Patent Yellow, Naples Yellow, Orpiment, Massicot, Yellow Ochre, Raw Sienna, Yellow Lake.

(4) *Reds.*—Vermilion (crimson and scarlet), Carmine, Cochineal Lake, Madder Lake, Red Lead or Minium, Indian Red, Venetian Red, Spanish Brown, Purple Brown, Orange Lead, Burnt Sienna.

(5.) *Browns.*—Umber (burnt and raw), burned Prussian Blue, Manganese Brown.

(6) *Blues.*—Prussian Blue, Cobalt, Ultramarine, French Ultramarine, Blue Verditer.

(7) *Greens.*—Verdigris, Scheele's Green, Emerald Green, Green Verditer, Italian Green, Saxon Green, Brunswick Green.

Recipes for Tints Produced by Mixing Simple Colors.

Straw Color.—Chrome yellow and white lead.

Lemon Color.—Chrome yellow and white lead; more of the first than in straw color.

Orange.—Chrome yellow and vermilion (bright), yellow ochre and red lead (duller).

Buff.—White lead and yellow ochre.

Cream Color.—Same as for buff, but with more white.

Gold Color.—Chrome yellow with a little vermilion and white lead; or Naples yellow and realgar.

Stone Color.—White lead and yellow ochre, with a little burnt or raw umber.

Stone Color (grey).—White lead, and a small quantity of black.

Drab.—White lead, burnt umber, and a little yellow ochre (warm); white lead, raw umber, and a little black (cool).

Flesh Color.—Lake, white lead, and a little vermilion.

Fawn Color.—Same as for flesh color, with stone ochre instead of lake.

Peach Color.—White lead, with vermilion, Indian red, or purple brown.

Sky Blue.—White lead, Prussian blue, and a little lake.

Olive.—Black, yellow, and a little blue; or yellow, pink, lamp black, and a little verdigris.

Chestnut.—Light red and black.

Salmon Color.—Venetian red and white lead.

Chocolate.—Black, with Spanish brown, or Venetian red.

Sage Green.—Prussian blue, raw umber, and a little ochre, with a little white.

Olive Green.—Raw umber and Prussian blue.

Pea Green.—White lead and Brunswick green; or white lead, Prussian blue, and some chrome yellow.

Pearl Gray.—White lead, with a little black, and a little Prussian blue or indigo.

Silver Gray.—Same as for pearl gray.

Gray (common).—White lead and a little black.

Lead Color.—White lead with black or indigo.

Violet.—Vermilion, white lead, and indigo or black.

Purple.—Violet as above, with the addition of a rich, dark red, or colors for French gray.

French Gray.—White lead with Prussian blue and a little lake.

Lilac.—Same as for French gray, but with less white.

Oak Color.—White lead with yellow ochre and burnt umber.

Mahogany Color.—A little black with purple brown or Venetian red.

In all operations of painting, varnishing, etc., it is of the greatest importance that everything used, whether slab, muller, knife, or brushes, should be kept thoroughly clean.

Varnishes, and Recipes for Making Varnishes.

Varnishes may be bought at the oil and color store at reasonable rates.

A few coats of varnish much improve painted or stained work by imparting to it a smooth and glossy surface. For some work, such as staining, one or two coats will be sufficient, but where it is desirable that the appearance of the article should be as good as it can possibly be made, eight or ten coats will have to be laid on. After the first three or four coats are given and thoroughly dry, take some fine glass-paper and smooth off the brush marks or any gritty particles that may have stuck to the varnish. Then give the work another coat of varnish, which serve in the same manner, and so on for every coat until the last, which should be polished with a flannel rubber dipped in Tripoli powder and water, and finished off with a powder made of suet and flour.

The same precautions must be observed with regard to the brushes used in varnishing as for painting. If put away wet with varnish, they will, after remaining unused for a day or two, be hard and utterly useless. They must, therefore, be well washed immediately after use, and will then be in proper order when again wanted.

Gold Varnish.—Thoroughly wash and cleanse from color one part of gum shellac; when dry pulverize it well, reducing it in a mortar to an impalpable powder; mix with it four times its weight of spirits of wine; put the mixture on the fire, and let it remain until the gum is entirely dissolved. Strain the liquor, and keep for use in a well-corked bottle.

Black Varnish for Metal, etc.—Fuse and thoroughly incorporate asphaltum, ¾ lb.; shellac, 2 oz.; turpentine, 1 quart. Lay on with a brush.

Polishing, and Recipes for Polish.

Polishing very greatly improves the appearance of articles made of any fancy wood or stained work. There are many different sorts of polish; but those for which recipes are given below will be found to answer the amateur's purpose in every way:

French Polish.—Spirits of wine, 1 pint; gum sandarac, ¼ oz.; gum lac, ½ oz.; gum shellac, ½ oz. Expose the whole to a gentle heat, frequently shaking the mixture until the gums are dissolved.

Naphtha Polish.—Wood naphtha, ½ pint; orange shellac, 1 oz.; dragons' blood, ¼ oz.; benzoin, ¼ oz. Prepare in the same way as French polish.

Shellac Polish.—Orange shellac, 1½ oz.; spirits of wine, 1 pint.

The method of applying these polishes is the same for all. A flannel rubber is made and dipped in the polish, and a piece of fine and old linen is then put over the rubber. When the polish oozes through the covering, dip the pad into or slightly moisten it with linseed oil. Another way is to strain the linen over the flannel pad, and then to moisten the linen with a drop or two of the polish and a drop or two of oil. The pad should be held in the right hand, and the linen strained tightly, so that the pad may present a rounded surface. Apply the pad to the surface of the wood in a series of light strokes made by a circular sweep of the hand until the surface is nearly dry, when the pad should be passed up and down in the direction of the grain of the wood. When the rubber is dry some more polish and oil must be put upon it in the same manner as before, and the rubbing continued.

Plenty of what is generally called "elbow-grease" should be given to the work, and not too much polish. Beginners generally lay on a large quantity of polish in clots or thick coats, but when this is done the polish does not look well, neither has it a permanent effect.

No more polish should be laid on than is absolutely necessary. The polish should be well rubbed in and finished off with a little pure naphtha or spirits of wine, whichever happens to be the spirit that is used in the polish. The naphtha or spirits of wine, as the case may be, should *at first* be laid on very gently and with great care, otherwise it will dissolve and remove the polish already laid on; but if proper care is taken its effect will be not only to give the polish a better gloss, but to render it more lasting. Some woods absorb a great deal of polish. In order to prevent this absorption, a coat of gold size, or something of a like nature, is given before the application of the polish. When polishing mahogany or other ornamental or colored wood, should there be any inequalities or faults in any conspicuous part of the object, fill them up with stopping, consisting of plaster of Paris mixed to the consistency of cream with water, tinted with staining or coloring matter corresponding with the color of the article that is to be polished. A mixture of putty, consisting of finely-pounded whiting and painters' drying oil and some coloring matter, will do quite as well. For large holes a composition of beeswax, resin, and shellac is found very useful.

Paper Hanging.

Next to painting, the most important decorative work that can be done within the house is paper-hanging, and a knowledge of the mode of doing this will often prove of great advantage to the amateur artisan, especially if he be a man of slender means.

Besides the American there are two other wallpapers used in paper-hanging, one being of English and the other of French manufacture. The French paper-hangings are perhaps prettier, more artistic, and produce a better effect than American or English-made papers, but they are much more expensive. They may be distinguished from English papers by their narrow width, the English papers being 22 inches wide and the French and American papers only 20 inches. Again, a *piece* of English paper is 12 yards long, and a *piece* of French paper about 9½ yards, the former covering 7 square yards, or 63 feet superficial, and the latter 4¾ square yards, or 41 square feet. Speaking approximately, therefore, where two pieces of English paper are required, three of French will be wanted at the very least, and in practice this will not be found to be enough.

The American paper is in more common use now, and for quality and artistic effect equals that of foreign make. It comes in *rolls* of *two pieces* each, or 16 yards, a piece being considered 8 yards long. The width is 20 inches over all or 18 inches net. A *piece* then will cover 36 square feet of surface.

On looking at a piece of wall-paper it will be found that the pattern does not come quite out to the edges, so that it must be remembered, in measuring a room for paper, that 18 inches is the absolute net width of the pattern (American); the actual roll of paper itself is wider than this. To measure a room, one method is to measure the circumference, making allowance for doors and windows, and, having ascertained the number of feet, multiply this by the height of the room and divide by the number of square feet in a piece of paper. For the ceiling multiply the length of the room by breadth, which will give area, and divide as before. If a room has offsets these may be measured separately. Thus, taking the room to be 18 ft. by 15 ft., and allowing 11 ft. for doors and windows, and taking the height of the room to be 9 ft., between skirting-board and cornice we have:

18ft. + 18ft. + 15ft. + 15ft. (length of 4 sides of room) — 11ft. (allowance for door and windows) × 9ft. (height between ceiling and skirting) ÷ 36 (No. of square feet in piece of paper).

Or 66 — 11 × 9 ÷ 36, or 55 × 9 ÷ 36 = 14 pieces, or 13 and a fraction, which requires of course 14 full pieces, or 7 rolls, for the sides. The ceiling would be 18 × 15 ÷ 36 = 7½, or 8 pieces.

Small Patterns Most Satisfactory.

The most satisfactory kind of pattern is a small geometrical one, consisting of some simple form, a leaf or flower, conventionally treated. For staircases, passages, etc., papers in imitation of wood or marble are most commonly used, and these can be preserved from much casual injury by varnishing. Marble papers are usually hung in large blocks, the lines of demarcation, horizontal and vertical, being traced, with the aid of a straight edge, in black or brown. For sitting-rooms satin papers, or papers with a glossy surface, are generally used. Papers in which gold is introduced are expensive if they are worth anything at all. In cheap gilt papers, the gold, which is most likely Dutch metal, soon tarnishes and changes as time goes on from a dull copper-red to black. It is good taste to have the ceiling paper light in color and with a subdued figure to harmonize with the sides.

Preliminary Work for Paper Hanging.

If the wall be new it will require sizing before the paper is put on, though this is by no means done as a rule. If the wall has to be re-papered, it must be stripped of the old paper, or *should be* stripped, as new papers are too frequently hung upon old papers; a procedure which is certainly not cleanly, and is in many cases prejudicial to health, because the dampness caused by putting up the new paper often detaches the old paper from the surface of the wall, and oftentimes, if the paste used in hanging the old paper has been bad, a fungus is generated, which spreads over the wall in dark patches of a brown or greenish color.

In re-papering a room after any one stricken down with some infectious disorder, such as scarlet or typhus fever, on no account should the old paper be left on the walls, but it should be carefully stripped and the walls washed, and the ceiling coated with limewash, after the old coating has been taken off with clean water. As soon as this is done, the walls may be sized and the process of re-papering may be proceeded with.

Size is a kind of weak glue, made from the clippings of parchment, glove-leather, fish-skin, and similar substances, by boiling them down in water. When cold it resembles jelly. It is sold by all oil and color dealers.

The wall being sized, it is necessary to determine what tools are absolutely necessary for the paper-hanger's work. These may be summed up as a pair of boards connected by hinges, or, if preferred, simply grooved and tongued together, or even joined by dowels or pins. The amateur need not provide himself with a pair of boards and trestles merely for the sake of papering a single room; a kitchen table, if long enough, or even a dining table suitably protected, will answer every purpose. The boards are portable, and, therefore, useful to the regular paper-hanger, who may not find any suitable table at the house to which he is going. They are also of greater length than most tables, which is obviously an advantage. Whether the amateur is provided with boards or not, he must of necessity have a pair of good-sized scissors; a pail to hold his paste, whether of wood or iron it matters not, so long as it is clean; and a paste brush, something similar to that used for whitewashing, but smaller.

Paste for Paper Hanging.

Good paste for paper-hanging is made of old flour, mixed to a milk-like consistency with water. When put in the saucepan to boil, a little size or glue may be added, which will increase its tenacity. A little alum may also be added to paste, in order to cause it to spread more freely; this ingredient has the property of keeping paste sweet and wholesome, and it is generally used in the thicker kinds of paste, such as shoemakers' paste, partly for this purpose. The paste when boiled should be of the thickness of ordinary gruel, and must be laid on the paper smoothly and equally with backward and forward strokes of the brush. Care should be taken not to load the brush with too much paste at one time, lest the paper should be rendered too damp. It will sometimes happen that through an over-abundance of paste a little is pressed out at the edges when the cloth is used to dab the paper against the wall. Any paste that makes its appearance should be removed by means of a sponge dipped in clean water, but the amateur must be careful to avoid smearing the colors of the paper. The colors will often be started in a slight degree by the influence of the damp paste, and if the surface be smeared the only thing that can be done is to paste a piece of fresh paper over the smear, which, if left as it is, will prove a continual eyesore.

Where to Begin to Hang Paper.

Where to make a commencement in hanging a room with paper will be a bit of a puzzle to the amateur paper-hanger. The rule is that the edges of the paper when hung shall be towards the window; that is to say, that if there be a window in the room the paper must be hung from either side of the window round the room, the junction being finally effected in some corner of the room or some recess, where the mismatching of the pattern would not be so apparent.

When it has been ascertained by actual measurement how much paper is required for hanging on each side of the commencement, wherever it may be, whether on each side of the window or from the middle line over a mantel-shelf, proceed to cut the paper. The usual way is to unroll the paper for a yard or two, cut the edge on one side, roll up the paper just cut, lightly and loosely, and continue unrolling, cutting, and rolling up by a yard or two at a time till the other end of the roll is reached. Some will then cut the other edge, proceeding in the same way until the paper is rolled as it was before the cutting commenced, having the topmost piece at the outer end. It is important to remember that whichever side is cut close to the pattern, the opposite side must not be cut closer than from ¼ in. to ½ in. of the pattern. The edge that is not cut close need not, in point of fact, be cut at all; the chief object in cutting it is to leave as small an extent of overlapping as possible where the strips are joined together. The best paper-hangers, who can set the paper to a line, trim close on both sides and do not overlap, but set to the edge.

Cutting Paper into Lengths.

When the edges are cut the next step is to cut the paper into lengths suitable to the height of the room, and this, whether the overplus at top and bottom be much or little, must be done in such a manner that when the second strip is pasted up by the side of the first the pattern will join neatly and exactly, leaving as few traces as possible, if it leave any, of the line of junction. The "match" is shown by certain marks on the edge of the paper, and if it be found that a considerable length of paper be left either at top or bottom, or at both, it will be better and more convenient for the amateur in carrying out the operation of hanging each slip to cut off the surplus paper, leaving no more than an inch or two at top and bottom beyond the length between skirting and cornice. Cut the paper straight across, which can be easily done by aid of the pattern, and cut as many lengths as will suffice for one or two sides of the room to begin with. Lay the lengths thus cut face downwards on the pasting-board, letting the edge of each strip as it is laid down project a little beyond the edge of that which is immediately below it, in which the uppermost strip is the last strip laid down. This prevents the paste from getting under the edges of the piece below when the piece above is being pasted.

Attaching to the Wall.

As many strips as may be required having been laid one on top of another on the board, the first strip may be pasted, but a little judgment must be used as to the time that may be allowed to elapse before the paper is attached to the wall. If the paper be cheap, and therefore thin and unsubstantial, it must be hung up as quickly as possible after the paste is put on; but if it be a stout, good paper, some two or three minutes may elapse between pasting and hanging; and a thick paper may be left even twice as long, to allow the damp to penetrate the paper and render it more easy of manipulation and less liable to be crushed or broken. For easier manipulation it is better to loop up the lower end of the paper, the paste causing the paper to adhere slightly where one part comes in contact with another. Then fold back the top, and putting the hands, which should be perfectly clean and free from paste, under this fold, attach the paper to the wall, bringing the top upwards with the hands to meet the cornice. Care should be taken beforehand to make a guide line on the wall, or to see that the woodwork round the window is perfectly upright, and this will assist the amateur in fixing the first strip truly perpendicular. After attaching it lightly to the wall, the plumb-line may be applied to see that all is true and vertical, and if all is right release the fold, and, after letting the paper hang straight down, lift it away from the wall, except for about six or eight inches below the cornice, and then let the strip fall, when it will gently float down into its place.

The next step is to press the paper against the surface of the wall in every part, and for this purpose the amateur must be provided with some clean soft cloths. First of all, the paper must be pressed down the middle from top to bottom with firm but gentle pressure, avoiding all rubbing, which may have the effect of starting the color and smearing and spoiling the paper. Then press from the centre outwards on both sides in a downward direction. The paper in some cases will lay smooth and flat against the wall, but if the paper be cheap and thin there will in all probability be many wrinkles all over the surface. Do not attempt to press these flat. The paper has stretched under the influence of the moisture of the paste, and as it dries it will contract again and lay as flat as possible all over the wall to which it is attached. Lastly, draw the scissors over the paper just below the cornice and just above the skirting-board, making a crease. Then pull the paper gently from the wall as far as may be necessary, cutting off the edges along the mark or crease made by the scissors, and restore the ends to their places, dabbing them lightly as before with the cloth, which should be so doubled up as to form a large, loose pad.

The second strip may now be put up in the same way. Here, however, the chief anxiety will be to match the pattern neatly, for if the first strip be put up perpendicularly the other strips will be perpendicular as a matter of course. Nevertheless it will be as well for the amateur to test his work occasionally by the plumb-line, to make sure that it is not getting out of the perpendicular.

It may be that the amateur will not be successful in his first effort, and then all that can be done is to sacrifice the strip of paper, pull it down, and try again. As in everything else, practice is necessary to enable a man to do this work well and quickly.

It will be advisable, then, for any beginner to try his 'prentice hand in an attic or some small room of no great consequence, in order to give him some idea of the way in which paper must be handled and attached to the wall. He will soon gain confidence in himself, and find no great difficulty in papering other rooms where it will be absolutely necessary that the work be neatly and accurately done.

Borders should be neat in design, and match the paper in this respect and in color, or if the colors do not harmonize they should be in agreeable contrast. A cable pattern generally looks well, or the Grecian rectangular pattern, known as the Greek key pattern. The representation of a simple molding is often very effective, and when the paper is plain in character and geometrical in pattern a floral border is admissible. It must be remembered, however, that a border, however good it may be, tends to detract from the apparent height of the room, and therefore is not so well calculated for a low room as for a high room, to which the horizontal lines of the border impart an appearance of breadth and space.

BELLS AND TELEPHONES

The electric bell constitutes one of the most simple pieces of apparatus for signaling by electricity, and although more than half a century has elapsed since it was first introduced, no better method of signaling or giving a *call* has yet been invented for land lines. It is always used for attracting attention in telephonic communication and very often also in telegraphy.

To Wire for and to Connect Electric Bells.

It is easy to understand that an electric bell equipment usually consists of one electric bell, one cell of battery, one push-button, and wire enough to connect the outfit for a reasonable distance.

The push-button is, of course, set at the place from which the signal is to be given, and, when connected, the pressing of the button should ring the bell. The bell should continue ringing as long as the button is pressed. The bell should be placed where the persons who are expected to answer it [when it rings] are likely to be, so it can be heard by them. The battery, the motive power, is placed at some convenient place, the closer the battery is placed to the push-button, the better for some work.

The wire is used to make the connection to the bell, battery, and push-button. The proper way to connect an electric bell outfit is to run one wire from the push-button to the battery, one wire from the push-button to the bell, and one wire from the bell to the battery. This gives two wire ends at each place, namely, bell, battery, and push-button. The bell, battery, and push-button each have two places where the wires are connected. To all places to which wires are connected the insulation covering of the wires must be removed, and the wire made clean and bright. Then connect it with the connecting places of the push-button, bell, and battery. This way of connecting an electric bell outfit is called a metallic circuit.

A Grounded Circuit.

On long distances wire can be saved by using a grounded circuit, which is done as follows: Drive a piece of iron into the earth, from four to five feet down, connect a wire to the iron driven into the ground by wrapping the bare wire tightly around the iron. This ground wire is then run to the battery and connected to the zinc side. A second wire is run from the carbon side of the battery to one side of the push-button; a second wire runs from the push-button to wherever the bell is placed; a wire is run from the bell to a second ground iron, and attached or connected to the ground iron, the same as the first ground connection was made. Where long distances are to be connected, namely, from house to stable, factory or any other building, this way of doing electric bell work is frequently done. All wires that are outside of buildings should be fastened on to porcelain or glass insulators, and never be nailed against brick or stone walls, or any frame buildings; always use insulators, and have wires clear of all places.

It is recommended for electric bell work that no lighter wire than what is known in the trade as No. 16 be used, and that the wire have a good insulation or covering.

Making Connections.

In all ordinary electric bell work, if reasonable care is taken, no connections or splices are necessary in the wire. Should it be necessary to make a connection of two ends of wire, make a good one and solder it; do not neglect doing this (soldering connections) in case you cannot solder the connections, wrap them with tin foil, or some tissue paper, and on top of this use some insulating tape, making a good covering over the wire again. Do not, however, use insulating tape right on a wire connection, as the place gets corroded, and is an injury to good work.

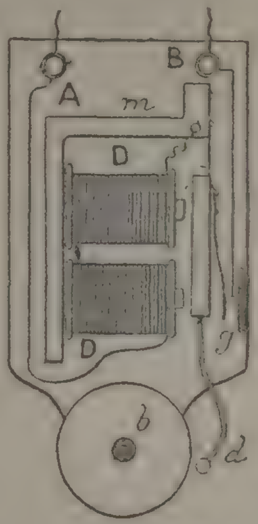
When it is desired electric bell work can be so arranged so one, two or more bells can be rung from one or as many more places as desired. This is all simple work, and can be easily understood by making electric bell circuit diagrams, to show similar points on same line.

The wire for push-buttons must be always connected in multiple, with the wire attached to the first push-button. This is easily done by making half connections. The push-button end of wires must always be so connected in open circuit bell work.

The bells when so connected that two or more ring simultaneously, should be also connected in multiple.

The Working of the Bell.

The electric bell consists essentially of an electro-magnet and a vibrating armature piece which oscillates in front of it. If a current enters the terminal A it is conducted through the coils D D of the electro-magnet, which has iron cores, and passes out through the metal of the armature, the contact screw, *g*, and the terminal B. Such a current will, of course, cause the electro-magnet to draw the armature down on to its terminals, the armature itself being attached by a flexible steel spring to the framework, so as to make this movement possible. In the act, however, of drawing down the armature, the contact of the screw *g*, and a prolongation of the armature spring, is broken, and as this contact forms part of the electric circuit, the current ceases to magnetize the electro-magnet; the armature is, therefore, no longer attracted and springs back by virtue of the steel spring, and contact between it and the screw, *g*, is restored, which causes the same operation to be repeated. This motion takes place very rapidly to and fro, and is communicated to a light hammer, *d*, which strikes the bell, *b*, and produces a continuous and loud ringing sound. The whole apparatus forms a simple method of drawing attention from a distance, and can always be relied upon to work properly.



—Electric Bell.

The only drawback to the bell is that if the screw, *g*, is set so as to make it as sensitive as possible, a vibration of the support to which the whole apparatus is fixed, due to a passing train or vehicle, might be sufficient to cause the hammer to strike the gong. In railway signal-boxes, where electric bells are much used, it is absolutely necessary that this should not happen, as it might lead to a serious catastrophe. The bells in this case are, therefore, so arranged that on closing the electric circuit the bell-hammer only strikes the gong once, and only when the circuit is broken again outside the bell does it spring back so as to be ready for a second signal.

Alternating Currents.

Such vibrating electric bells will work with both direct and alternating currents, but not nearly so well with the latter. As, however, it is very often found desirable to use alternating currents, a special *polarized* bell has been devised for use with them, in which the armature, the amplitude of whose movement is regulated by screws, vibrates in a vertical plane between two poles of an electro-magnet, bent round at right angles.

No make-and-break mechanism is necessary as in ordinary bells, because the alternating current is continuously reversing the sign of the poles of the electro-magnet, causing the armature and bell-hammer to vibrate, by alternate attraction and repulsion. It is usual in these bells to intensify the sound by using two domes, making use of the return stroke of the hammer.

The current is produced by a small magneto dynamo worked by hand. This method of dispensing with primary batteries is due to Siemens, and has the advantage that a high E.M.F. (Electric Motive Force) can be generated at no expense, the power being supplied by the operator himself.

Cautions to be Observed.

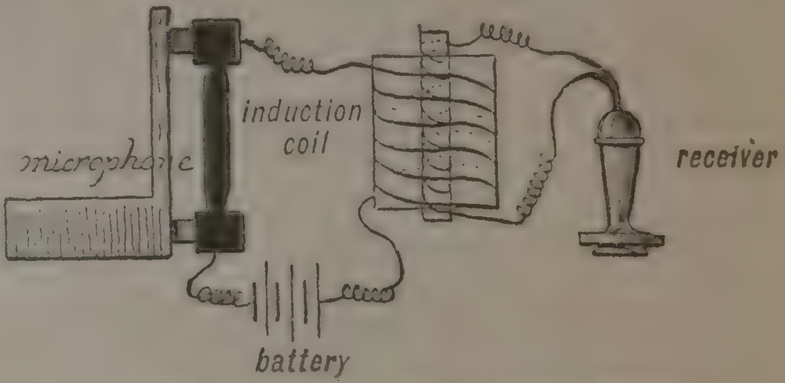
To sum up, then, let us say that in putting up electric bells, telephones, etc., there are several points which must be carefully attended to, if satisfactory working is desired; the conducting wires must be as well insulated as possible. Mere touching contacts should be avoided unless absolutely necessary. If possible contacts or joints should be soldered so as to make a good metallic connection. If any connections are made by terminals or binding screws, they must be carefully cleaned and seen to from time to time; this remark applies especially to the battery terminals, which are more likely to become corroded by the electrolyte. The general arrangement of the wires should be first mapped out on paper, and this plan carefully adhered to in putting them up, otherwise confusion and trouble will arise.

Putting up Telephones.

There are two very distinct methods of *transmitting* the voice possible in telephonic systems: electro-magnetic *transmitters* for use without batteries, and transmitters on the microphone principle requiring some external source of current. The instruments for receiving the voice are called *receivers*, and are always based on the principle of the electro-magnetic transmitter.

The first practical telephone was invented by Graham Bell, and patented by him in 1877; it was also invented independently about the same time by Elisha Gray. The principle of this telephone is based on the laws of electro-magnetic induction.

A complete apparatus for telephonic communication consists: at the transmitting station, of a microphone, battery, and induction coil, and a bell-push which rings a bell at the receiving station to draw attention; at the receiving end, of Bell telephone receiver and the call-bell.



Apparatus for the Transmission of Sound by Electricity.

Line Wires.

In towns, each person having a telephone is connected to an exchange, and by which he can be connected at will to any other person also connected to the exchange.

The line wires, connecting the transmitting and receiving stations, consist of two copper conductors of high conductivity and great tensile strength. It is found that alloys of copper and silicon, or copper and aluminium, are best for this purpose. The wires have a resistance of about 80 ohms per mile, and their breaking tension is about 150 lbs. With wire weighing about 19 lbs. per mile, spans of 100 to 150 yards are possible. The wires, if overhead, are supported on porcelain insulators, which are attached at a convenient height from the ground to posts or houses; in the country trees often come in handy for the purpose. In cities the best method is to lay them underground, where they are safe from the effects of fire or weather; this, however, is rarely done, as overhead wires are so very much cheaper.

If a telephone line does not run anywhere near any other telephone, telegraph, or electric circuit, the return wire may be replaced with economy by the earth. In this case very careful connection must be made with the earth at each end. A good plan is to solder the connecting wire to a water pipe, but if this is not available, it must be connected to a large metallic plate of copper buried deeply in damp earth, which it is as well to water from time to time. It is best to avoid this earth return for telephones if possible, as it is very seldom satisfactory.

In fixing up the telephone apparatus it should never be attached to thin partitions which are capable of vibration, but should be screwed to a solid wall, and even then it is as well to place a couple of layers of felt between the instrument and the wall.

Number of Bells Required.

A couple of cells of almost any make such as Daniells or Le Clanche are quite enough for working a short telephone line, and for longer distances three or four at the outside are sufficient, for, an excess of electromotor force produces a crackling sound in the receivers, which may be loud enough to seriously inconvenience conversation. For electric bells the number of cells required depends upon the length of the line and the resistance of the bells used, and the right number is usually found by experiment.

If a telephonic line is to be established near a telegraph line, it becomes necessary to use a metallic wire for the return, because the effects of induction, due to the making and breaking of the telegraph current, when an earth return is used by both circuits, becomes sometimes great enough to spoil all telephonic communication.

As a matter of fact it is very seldom that an earth return can be used for telephone lines, for the circuit is then always liable to external disturbances, such as leaks from electric light and power circuits, telegraph currents, earth currents, etc. Even with twin wires the greatest attention must be paid to good insulation of the line, otherwise the above-mentioned disturbances may make their influence felt. When all such stray currents have been eliminated from the system, the length of a telephone line may be greatly increased; conversation has been carried on quite distinctly at distances of 800 and 900 miles.

Operating a Telephone.

The manipulation of a telephone instrument is quite simple. In nearly every type of instrument the receivers are hung on a hook which is pivoted on an axis. This movable hook has a spring attached to it so that, when the receiver is hung on it, the hook falls and distends the spring. If the receiver is unhooked the spring is released and the hook is drawn up. It is really a switch, and the up-and-down movement causes the proper connections of line and bell, and line and telephone to be made. To enter into communication with another person through the exchange, the handle of the magneto-generator is turned, or a button is pressed. The exchange answer the signal by ringing the subscriber's bell. The receiver is then unhooked and placed to the ear, and the mouth is placed opposite the microphone. The attendant at the exchange asks what number is required, which being given the proper connection is made there, and the two persons are now in direct communication. When the conversation is finished, the bell is again rung to signify the fact, and the attendant at the exchange disconnects them.

Batteries.

Batteries are connected by attaching the carbon side of one cell to the zinc side of the next; follow this for any number and there will always remain one carbon pole and one zinc pole to which line wires may be connected. Batteries should be examined occasionally and cleaned. Do not use more salamoniac than will readily dissolve and have a small amount in bottom of cell. Place the batteries so they may not be exposed to draughts or heat. Use soft rainwater in the solution. Six ounces of salamoniac to a jar is enough. When the batteries appear to be doing too much work or become weak, examine all connections; look for leaks where wires cross or touch. Test each battery separately by connecting it with the two poles of a bell used for that purpose.

The practical mechanic—the amateur workman—the busy man of affairs—the housekeeper—the farmer, have occasions for useful information about the common materials used in building and repairing and for the tables and measurements used in the different trades and business pursuits, which are seldom found outside of books treating of special trades. These facts and figures also enable one to deal intelligently with the mechanic and tradesman. They are *time-savers*, and hence are *money-makers*. Such information is only secured after long and diligent search and comparison of authorities. We give many of the important ones.

FACTS AND FIGURES FOR EVERY DAY USE

Shingles.

The best shingles are of white cedar. When of good quality, they will last 40 to 50 years in our Northern States. Cypress and white pine are much used for shingles, but will not last half as long as white cedar.

Shingles are packed 250 to the bundle, or 4 bundles to 1,000.

1 Bundle 16-inch shingles will cover 30 square feet.

1 Bundle 18-inch shingles will cover 33 square feet.

When laid 5½ inches to the weather, 5 lbs. 4° or 3¾ lbs. 3° nails will lay 1,000 shingles.

Clap-Boards.

1 Bundle laid 3½ inches to the weather will cover 26 square feet.

Painting.

For outside wood-work, paint made from white lead ground in linseed oil is most used. If the oil is *raw*, or unboiled, *dryer* is added; if *boiled*, no dryer is necessary. Not less than four coats should be applied—five are better.

Paint, ready mixed, put up in cans or kegs, may be procured from manufacturers or dealers. These paints have to be thinned by adding 1 pint of oil to about 2½ lbs. of paint. When thinned, 1 lb. will cover about 2 square yards of first-coat, 3 yards of second, and 4 yards of each subsequent coat; or 1⅜ lbs. to the square yard will be required for 4 coats, and 1⅝ lbs. for 5 coats.

For inside work, either white lead or oxide of zinc is used, and for good work 4 coats are necessary.

For iron exposed to the weather, metallic paints, such as yellow and red iron ochres or brown hematite ore, finely pulverized and mixed with oil or dryer, are best.

For iron subject to the action of water, red lead is best.

Plastered walls should stand a year before painting.

Painting is measured by the square yard, girding every part of the work that is covered by paint and allowing an addition to the actual surface for the difficulty of covering deep quirk of moldings and for "cutting in" as in sash and shelving, or where there is a change of color, on same work.

Painter's Putty.

Spanish whiting, pulverized,	80.6	Made into a stiff paste. If not intended for immediate use, raw oil should be used.
Boiled oil,	20.4	

One pound of putty for stopping every 20 yards.

Glazier's Putty.

Whiting, 70 lbs.; boiled oil, 30 lbs.; water, 2 galls. Mix. If too thin, add more whiting; if too thick, add more oil.

To Soften Putty.

To remove old putty from broken windows, dip a small brush in nitro-muriatic acid or caustic soda (concentrated lye), and with it anoint or paint over the dry putty that adheres to the broken glass and frames of your windows; after an hour's interval the putty will have become so soft as to be easily removable.

White and Other Washes.

For outside wood-work. In a tight bushel, slake half a bushel of fresh lime by pouring over it boiling water sufficient to cover it 4 or 5 inches deep, stir until slaked: add 2 lbs. of sulphate of zinc dissolved in water, add water enough to bring all to the consistency of thick whitewash.

For inside work. Add 2 quarts of thin size to a pailful of wash just before using. The common practice of mixing salt with whitewash should not be permitted.

For brick or stone-work. Slake ½ bushel of lime, as before, in a barrel; then fill the barrel ⅔ full of water and add a bushel of hydraulic cement; add 3 lbs. sulphate of zinc dissolved in water. These washes may be colored by adding powdered ochre, umber, etc.

Stone-Work.

A perch of stone work is 1 rod long, 1½ feet thick and 1 foot high, and contains 24¾ cubic feet.

A cord of stone, like a cord of wood, contains 128 cubic feet, and will make a 100 cubic feet of wall. Three bushels of lime and a cubic yard of sand are usually estimated for a cord of stone.

Stone walls are measured by the perch (24¾ cubic feet). Openings less than 3 feet wide are counted solid; over 3 feet deducted, but 18 inches are added to the running measure for each jamb built. Arches are counted solid from their spring. Corners of buildings are measured twice. Pillars less than 3 feet are counted on 3 sides as lineal, multiplied by fourth side and depth.

It is customary to measure all foundation and dimension stone by the cubic foot. Water tables and base courses by lineal feet. All sills and lintels or ashlar, by superficial feet, and no wall less than 18 inches thick.

The greatest safe load per super. foot on

Granite Piers	40 tons.
Lime stone Piers	25 "
Sand stone Piers	15 "
Brickwork in Cement	3 "
Rubble Masonry	2 "
Lime Concrete Foundations . .	2½ "

The height of brick or stone piers should not exceed 12 times their least thickness at base.

Concrete Walls.

Concrete walls for houses are built of 1 of cement to 6 or 7 of broken stone, shingle, gravel, or slag. The substance mixed with the cement must be free from loam, fine sand, clay, or dirt of any kind.

To prevent the cement from adhering to the planks of the mould, apply freely to them, with a brush, soap boiled to the consistancy of paint.

Plastering.

Estimate of material for 100 square yards.

Materials	Two coats slipped coat finish	Three coats with hard finish
Quicklime	3½ casks	4 casks
" for fine stuff .		⅔ "
Plaster of Paris		½ "
Laths	2,000	2,000
Hair	3 bushels	4 bushels
Common Sand	6 loads	7 loads
White Sand		2½ bushels
Nails	13 lbs.	13 lbs.
Mason's labor	3½ days	4 days
Laborer	2 "	3 "

Plastering laths are usually of white or yellow pine, 1½ inches wide, ¼ inch thick, and 3 or 4 feet long. They are nailed up horizontally, about ½ inch apart. The upright stud of partitions are spaced at such distances apart, (usually about 15 inches centre to centre), that the ends of the laths may be nailed to them. Laths are sold in bundles of 1,000 each. A square foot of surface requires 1½ four-feet laths, or 1,000 such laths will cover 666 square feet. A carpenter can nail up the laths for from 40 to 60 square yards of plastering in a day of ten hours, depending on the number of angles in the room, etc.

Plastering is always measured by the square yard for plain work, by the superficial foot for cornices of plain members, and by lineal foot for enriched or carved mouldings in cornices.

Brick-Work.

Brick-work is generally measured by 1,000 bricks laid in the wall. In consequence of variations in size of bricks, no rule for volume of laid brick can be exact. The following scale is given as a fair average for general use.

7	Bricks to a super. foot	4″	Wall= 40 lbs.
14	" " "	9″	" = 94 "
21	" " "	13″	" =121 "
28	" " "	18″	" =168 "
35	" " "	22″	" =210 "

Corners are not measured twice as in stonework. Openings over 2 feet square are deducted. Arches are counted from the spring. Fancy work counted 1½ bricks for 1. Pillars are measured on their face only.

A cubic yard of mortar requires 1 cubic yard of sand and 9 bushels of lime, and will fill 30 hods.

One thousand bricks, closely stacked, occupy about 56 cubic feet.

One thousand old bricks, cleaned and loosely stacked, occupy about 72 cubic feet.

One superficial foot of gauged arches requires 10 bricks.

Stock bricks commonly measure 8¾ inches by 4¼ inches by 2¾ inches, and weigh from 5 to 6 lbs. each.

Paving-bricks should measure 9 inches by 4½ inches by 1¾ inches, and weigh about 4½ lbs. each.

One yard of paving requires 36 stock bricks, of above dimensions, laid flat, or 52 on edge; and 35 paving bricks laid flat, or 82 on edge.

Slating.

A square of slate or slating is 100 superficial feet.

In measuring, the width of the eaves is allowed at the widest part. Hips, valleys, and cutting are to be measured lineal, and 6 inches width extra is allowed.

The thickness of slates ranges from 3–16 to 5–16 of a inch, and their weight varies from 2.6 to 4.5 lbs. per square foot.

The *lap* of slates varies from 2 to 4 inches. The standard is assumed to be 3 inches.

To compute the number of slates of a given size required per squares.

Subtract 3 inches from the length of the slate, multiply the remainder by the width and divide by 2. Divide 14.400 by the number so found, and the result will be the number of slates required.

The *pitch* of a slate roof should not be less than 1 in. height to 4 in. length.

Dimensions of slates and numbers required to a square. 12x6 requires 533 to the square; 14x9 requires 291; 18x9 requires 213; 24x13 requires 105.

Rules for Obtaining Approximate Weight of Iron.

For Round Bars.

Rule: Multiply the square of the diameter in inches by the length in feet, and that product by 2.6. The product will be the weight in pounds, nearly.

For Square and Flat Bars.

Rule: Multiply the area of the end of the bar in inches by the length in feet, and that by 3.32. The product will be the weight in pounds, nearly.

Wrought Iron, usually assumed:

A cubic foot =480 lbs.
A square foot, 1 inch thick = 40 "
A bar 1 in. square, 1 foot long = 3½"
A " " " 1 yard long = 10 "

To find the weight of Cast-Iron Balls when the diameter is given.

Rule: Multiply the cube of the diameter by .1377.

To find the diameter of Cast-Iron Balls when the weight is given.

Rule: Multiply the cube root of the weight by 1.936.

To find the weight of a Spherical Shell.

From the weight of a ball of the outer diameter subtract the weight of the inner diameters.

To Test Quality of Iron.

If fracture gives long silky fibres of leaden-gray hue, fibres cohering and twisting together before breaking, may be considered *a tough, soft iron*. A medium even grain mixed with fibres, a good sign. A short, blackish fibre indicates badly-refined iron. A very fine grain denotes a *hard, steely iron*, apt to be cold, short, hard to work with the file. Coarse grain with brilliant crystallized fracture, yellow or brown spots, denotes a *brittle iron*, cold, short, working easily when heated; welds easily. Cracks on the edge of bars, sign of hot, short iron.. Good iron is readily heated, soft under the hammer, and throws out but few sparks.

All iron contains more or less carbon—the hardest the most.

The breaking strain on various metals is shown in the following table, the size of the rod tested being in each case one inch square, and the number of pounds the actual breaking strain:

	Pounds.
Hard steel, ...	150,000
Soft steel, ...	120,000
Best Swedish iron, ...	84,000
Ordinary bar iron, ...	70,000
Silver, ...	41,000
Copper, ...	35,000
Gold, ...	22,000
Tin, ...	5,500
Zinc, ...	2,600
Lead, ...	860

Average Weight of Animals.

Cart-horse,	14 cwt.	Riding-horse,	11 cwt.
Ox,	7 to 8 "	Pig,	1 to 1½ "
Cow,	6½ to 8 "	Sheep,	1 "

Average weight of a man, 140 lbs.

A dense crowd of people, 85 lbs. per square foot.

Average Number of Cubic Feet Per Ton of Various Substances for Estimating Work or Stowage.

Iron	4.7
Lead	3.2
Brick	22
Clay	22
Sand	24
Earth, loose	28
Granite	16
Oak	39.5
Ash	45
Cedar	72
Mahogany, sp.	45
Deal	50
Pine, red	55
" yellow	77
Water, fresh	36
" salt	35
Coke	90
Coal (stowed)	48
Wood (equivalent) requires	288

WORKSHOP RECIPES

A Home-Made Lubricator.—Tallow and plumbago thoroughly mixed make the best lubricator for surfaces when one is wood or when both are wood. Oil is not so good as tallow to mix with plumbago for the lubrication of wooden surfaces, because oil penetrates and saturates the wood to a greater degree than tallow, causing it to swell more.

To Protect Metal Surfaces From Rusting.—Melt 1 oz. of resin in a gill of linseed oil, and while hot mix with it two quarts of kerosene oil. This can be kept ready to apply at any time with a brush or rag to any tools or implements required to lay by for a time, preventing any rust, and saving much vexation when the tool is to be used again.

Glue to Resist Moisture.—1 lb. of glue melted in 2 quarts skim-milk.

Marine Glue.—1 part of India-rubber, 12 parts of mineral naphtha or coal-tar. Heat gently, mix, and add 20 parts of powdered shellac. Pour out on a slab to cool. When used, to be heated to about [illegible].

Glue Cement to Resist Moisture.—1 part glue, 1 part black rosin, ¼ part red ochre. Mixed with least possible quantity of water. Or 4 parts of glue, or 1 part oxide of iron, 1 part of boiled oil (by weight).

To Remove Rust From Steel.—Steel which has been rusted can be cleaned by brushing with a paste compound of ½ oz. cyanide potassium, ½ oz. castile soap, 1 oz. whiting, and water sufficient to form a paste. The steel should be washed with a solution of ½ oz. cyanide potassium in 2 oz. water.

To Preserve Steel From Rust.—1 part caoutchouc, 16 parts turpentine. Dissolve with a gentle heat, then add 8 parts boiled oil. Mix by bringing them to the heat of boiling water; apply to the steel with a brush, in the way of varnish. It may be removed with turpentine.

To Clean Brass.—1 part Roche alum and 16 parts water. Mix. The articles to be cleaned must be made warm, then rubbed with the above mixture, and finished with fine tripoli.

Blue Print Solution for Photographer.—1 pint citrate of iron ammonia, 2 pints red prussiate of potash, 1 pint gum arabic, 3 pints water.

Do.—1¼ oz. red prussiate of potash in 11 oz. water, 1⅞ oz. citrate of ammonia in 5 oz. water. Mix together and keep in dark place. Corrections can be made with a pen dipped in a solution of caustic soda. Also by bi-carbonate of soda. Also by a solution of lime.

Tinning Acid for Zinc or Brass.—Zinc, 3 oz.; muriatic acid, 1 pt. Dissolve, and add 1 pt. water and 1 oz. sal-ammoniac.

To Solder Brass Easily.—Cut out a piece of tinfoil the size of the surface to be soldered. Then apply to the surface a solution of sal-ammoniac for a flux. Place the tinfoil between the pieces, and apply a hot soldering-iron until the tinfoil is melted.

To Solder Without Heat.—Steel filings, 2 oz.; brass filings, 2 oz.; fluoric acid, 1¼ oz. Dissolve the fillings in the acid, and apply to the parts to be soldered, having first thoroughly cleaned the parts to be connected. Keep the fluoric acid in earthen or lead vessels only.

To Tin Brass and Copper.—Make a mixture of 3 lbs. cream of tartar, 4 lbs. tin shavings, and 2 gallons water, and boil. After the mixture has boiled sufficiently, put in the articles to be tinned, and continue the boiling. The tin will be precipitated on the articles.

To Use in Case of Burns.—A free application of soft soap to a fresh burn almost instantly removes the fire from the flesh. If the injury is very severe, as soon as the pain ceases apply linseed oil, and then dust over with fine flour. When this covering dries hard, repeat the oil and flour dressing until a good coating is obtained. When the latter dries, allow it to stand until it cracks and falls off, as it will in a day or two, and a new skin will be found to have formed where the skin was burned.

How to Mix Inks or Paints for Tints.—A larger quantity of the first-named color must always be used. Dark green and purple make bottle green. White and medium yellow make buff tint. Red, black, and blue make dark brown. Bronze blue, lemon yellow, and black make dark green. White, medium yellow, and black make drab tint. White, lake, and lemon yellow make flesh tint. Lemon yellow and bronze blue make grass green. White and black make gray tint. White and purple make lavender tint. Red, black, and medium yellow make maroon. Lake and purple make magenta. Medium yellow and purple make olive green. Medium yellow and red make orange. White, ultramarine blue, and black make pearl tint. White and lake make pink. Ultramarine blue and lake make purple. Orange, lake, and purple make russet. Medium yellow, red, and white make sienna. White and ultramarine blue make sky blue. Ultramarine blue, black, and white make slate. Vermillion and black make Turkey red. White, yellow, red, and black make umber.

Time-Savers.—We give the following figures as worth remembering. They will save calculation and give approximately accurate results with least amount of labor:

Four loads, (cubic yds.) of stone, three bushels of lime and a cubic yard of sand, will lay one hundred cubic feet of wall.

Five courses of brick will lay a foot in height on a chimney.

Nine bricks in a course will make a flue eight inches wide and twenty inches long, and eight bricks in a course will make a flue eight inches wide and sixteen inches long.

Eight bushels of good lime, sixteen bushels of sand and one bushel of hair, will make enough mortar to plaster one hundred square yards.

One-fifth more siding and flooring is needed than the number of square feet of surface to be covered, because of the lap in the siding and matching of the floor.

One thousand laths will cover seventy yards of surface, and eleven pounds of lath nails will nail them on.

One thousand shingles laid four inches to the weather, will cover one hundred square feet of surface, and five pounds of shingle nails will fasten them on.

A Polish for Wood.—The wooden parts of tools, such as the stocks of planes and handles of chisels, are often made to have a nice appearance by French polishing; but this adds nothing to their durability. A much better plan is to let them soak in linseed oil for a week, and rub with a new cloth for a few minutes every day for a week or two. This produces a beautiful surface, and has a solidifying effect on the wood.

To Calculate the Number of Shingles for a Roof.—To calculate number of shingles for a roof, ascertain number of square feet, and multiply by four, if two inches to weather, 8 for 4½ inches; and 7 1-5 if 5 inches are exposed. The length of a rafter of one-third pitch is equal to three-fifths of width of building adding projection.

A Chimney that Will Draw.—To build a chimney that will draw forever, and not fill up with soot, you must build it large enough, sixteen inches square; use good brick, and clay instead of lime up to the comb; plaster it inside with clay mixed with salt; for chimney tops use the very best of brick, wet them and lay them in cement mortar. The chimney should not be built tight to beams and rafters; there is where the cracks in your chimney comes, and where most of the fires originate, as the chimney sometimes get red hot. A chimney built from the cellar up is better and less dangerous than one hung on the wall.

Keeping Tools.—Keep your tools handy and in good condition. This applies everywhere and in every place, from the smallest shop to the greatest mechanical establishment in the world. Every tool should have its exact place, and should always be kept there when not in use.

Keeping tools in good order, and ready to use, is as necessary as keeping them in the proper place. To take up a dull saw, or a dull chisel, and try to do any kind of work with it, is worse than pulling a boat with a broom, and it all comes from just the same source as throwing down tools carelessly—habit, nothing more or less. To say you have no time to sharpen is worse than outright lying, for, if you have time to use a dull tool, you have time to put it in good order.

Three Thermometer Scales.—There are three standard thermometers in use, each a recognized standard in one or another part of the world. The scale of Reaumur (R.) prevails in Germany. As is well known, he divides the space between the freezing and boiling points into 80°. France uses that of Celsius (C.), who graduated his scale on the decimal system. The most peculiar scale of all however, is that of Fahrenheit (F.), a renowned German physicist, who in 1714 or 1715 composed his scale, having ascertained that water can be cooled under the freezing point without congealing. He did not take the congealing point of water, which is uncertain, but composed a mixture of equal parts of snow and *Sal Ammoniac*, about—14° R. This scale is preferable to both those of Reaumur and Celsius, or, as it is called, Centigrade, because: 1. The regular temperatures of the moderate zone move within its two zeros, and can therefore be written without + or —. 2. The scale is divided so finely that it is not necessary to use fractions, when careful observations are to be made. These advantages, although drawn into question by some, have been considered so weighty, that both Great Britain and America have retained the scales, while the nations of the Continent use the other two. The conversion of any one of these scales into another is very simple. 1. To change a temperature given by Fahrenheit's scale into the same given by the Centigrade scale, subtract 32° from Fahrenheit's degrees and multiply the remainder by 5-9. The product will be the temperature in Centigrade degrees. To change from Fahrenheit's to Reaumur's scale, subtract 32° from Fahrenheit's degrees, and multiply the remainder by 4-9. The product will be the temperature in Reaumur's degrees. 3. To change a temperature given by the Centigrade scale into the same given by Fahrenheit, multiply the Centigrade degrees by 9-5, and add 32° to the product. The sum will be the temperature by Fahrenheit's scale. 4. To change from Reaumur's to Fahrenheit's scale, multiply the degrees on Reaumur's scale by 9-4, and add 32° to the product. The sum will be the temperature by Fahrenheit's scale.

Weighing Liquids.—One gallon of pure water weighs nearly 8½ lbs. avoirdupois. "A pint is a pound" is an old saying, and very nearly true. The gallon containing 231 cubic inches, is the standard unit of wine measure. The British gallon, called the Imperial gallon, contains 277.274 cubic inches.

ENGINES AND BOILERS

Steam Boilers.—For all boilers three different parts, viz., fire-surface, water-space and steam-room, must be considered. Each part or division has a distinct and separate duty to perform. The fire-surface includes the furnace and combustion chamber, flues and tubes; the water-space is that part occupied by the water; and the steam-room is the reservoir which holds and supplies the steam necessary to run the engine.

For convenience, we may state that all steam-boilers are either internally or externally fired. When the fuel is burned in an iron furnace surrounded with a water-jacket or water-log, as in the case of the locomotive, marine and portable boilers, they are internally fired. Cylinder-flue, double-deck, tubulous and sectional boilers are said to be externally fired, because the fuel is burned in a brick furnace lined with fire-brick.

A perfect steam-boiler should be made of the best material sanctioned by use, and should be simple in construction. It should have a constant and thorough circulation of water throughout the boiler, so as to maintain all parts at one temperature.

There should be a combustion chamber so arranged that the combustion of the gases commenced in the furnace may be completed before the escape to the chimney.

Have all parts readily accessible for cleaning and repairs.

In every boiler there should be ample water-surface for the disengagement of the steam from the water in order to prevent foaming. There should also be a large excess of strength over any legitimate strain, and proportioned for the work to be done.

Only the very best gauges, safety-valves, fusible plugs, and other fixtures should be used.

In a *water-tube boiler* there should be from 10 to 12 square feet of heating surface for one horse-power; in a *tubular boiler* 14 to 18 square feet of heating surface for one horse-power; in a *flue boiler* 8 to 12 square feet of heating surface for one horse-power; a *plain cylinder boiler* should have from 6 to 10 square feet of heating surface for one horse-power; a *locomotive boiler* should have 12 to 16 square feet of heating surface for one horse-power; a *vertical boiler* should have from 15 to 20 square feet of heating surface for one horse-power.

When considering the heating surface of a boiler, a vertical or upright surface has only one-half the evaporative value of a horizontal surface above the flame; that is, the sides of a locomotive fire-box are only half as effective per square foot as the flat top of the box. In flues and tubes, the effective surface, measured on the circumference, is 1¼ times the diameter.

Useful Rules for Calculations.

To find the fire-grate surface of flue boilers.—Square the nominal horse-power, and divide it by the heating surface in *square yards;* the quotient will be the fire-grate surface in square feet—or, one square foot of fire-grate surface per nominal horse-power.

To find the heating surface of a flue boiler.—Square the nominal horse-power as indicated by the manufacturer's receipt or bill of sale, and divide that by the fire-grate surface in *square feet;* the quotient will be the heating surface in *square yards.*

Capacity of boiler flue.—One cubic yard of boiler capacity for each nominal horse-power. *Steam-room* should be about eight times the contents of the cylinder of the engine supplied with steam by the boiler.

Tubular or marine boilers.—Each nominal horse-power requires the evaporation of one cubic foot of water per hour; 12 square feet of heating surface, only three-fourths of the whole tube surface being taken as effective; and 30 square inches of fire-grate per nominal horse-power. The sectional area of the tubes to be about one-sixth of the fire-grate.

General rule for all classes of boilers.—Twelve square feet of heating surface and three-fourths square foot of fire-grate per nominal horse-power, are very good proportions.

TEMPERATURE INDICATED BY THE COLOR OF THE FIRE.

To determine the temperature of a furnace fire from the color of the flame:

Faint red	960° F.
Bright red	1,300° F.
Cherry red	1,600° F.
Dull orange	2,000° F.
Bright orange	2,100° F.
White heat	2,400° F.
Brilliant white heat	2,700° F.

How to Care for Boilers.

Every one who owns a steam-boiler, as well as the engineer who is responsible for the same, should at all times exercise the greatest care. A fifteen-story building may be fire-proof and ever so strong, yet a defective boiler in the basement or carelessness in its management, may cause an explosion which will wreck the whole structure. The following suggestions are important:

1. Great care should be exercised to see that safety-valves are ample in size and in working order. Overloading or neglect frequently leads to the most disastrous results. Safety-valves should be tried at least once a day to see if they will act properly.

2. The first duty of an engineer before starting is to see that the water is at the proper height. Do not rely on glass gauges, floats or water alarms, but try the gauge-cocks.

3. The steam-gauge should stand at zero when the pressure is off, and it should show same pressure as the safety-valve when the latter is blowing off. If not, then one is wrong, and the gauge should be tested by one known to be correct.

4. Both gauge-cocks and water-gauges must be kept clean. Water-gauges should be blown out frequently, and the glasses and passages to gauge kept clean.

5. Feed-pumps or injectors should be kept in perfect order, and of ample size. No make of pump can be expected to be continuously reliable without regular and careful attention. It is always safe to have two means of feeding the boiler. Check-valves and self-acting feed-valves should be frequently examined and cleaned. Satisfy yourself that the valve is acting when the feed-pump is at work.

6. Cold water should never be fed into a boiler if it can be avoided, but, when necessary, it should be caused to mix with the heated water before coming in contact with any portion of the boiler.

7. In case of low water immediately cover the fire with ashes (wet if possible) or any earth that may be at hand. If nothing else is handy use fresh coal. Draw fires as soon as it can be done without increasing the heat. *Neither turn on the feed, start or stop engine, or lift safety-valve until fires are out and the boiler cooled down.*

8. Fusible plugs, when used, must be examined when the boiler is cleaned, and carefully scraped clean on both water and fire sides, or they are liable not to act.

9. Moderately thick fires are most economical, but thin firing must be used when draught is poor. Take care to keep the grates evenly covered, and allow no air-holes in the fire. Be especially careful to lay the coal along the sides and in the corners. All lumps should be broken into the size of a man's fist. With bituminous coal, firing in front, and then shoving the coal back, when it is coked, gives the best result. Do not "clean" fires oftener than necessary. The cleaning of the fire is best done, in ordinary working, by a "rake," or other tool, working on the under side of the grate, and not by a "slice-bar," driven into the mass of fuel *above* the grates.

10. Clean all heating surfaces outside and in, or there will be serious waste of fuel. As a rule, never allow over one-sixteenth scales or soot to collect on surfaces between cleanings. Hand-holes should be frequently removed, and surfaces examined, particularly in case of a new boiler, until proper intervals between cleanings have been established by experience. Examine mud-drums and remove sediment therefrom.

11. When foaming occurs in a boiler, checking the outflow of the steam will usually stop it. If caused by dirty water, blowing down and pumping up will generally cure it. In cases of violent foaming, check the draught and cover the fires.

12. Never empty the boiler while the brickwork is hot.

13. Don't indulge in rapid firing. Steam should be raised slowly from a cold boiler.

14. If a boiler is not required for some time, empty and dry it thoroughly. If this is impractical, fill it quite full of water, and put in a quantity of common washing soda.

15. All things about the boiler-room should be kept clean and in good order. Negligence tends to waste and decay.

For the Engineer and Firemen

Always start your engine slowly, so that the air and water condensation can be expelled from your cold cylinder; then you will gradually bring it to its regular speed.

Keep open the drip cock, both in the front and back ends of the cylinder, when the engine is standing still, and never close them until all the water has dripped out.

Never let in any oil or tallow to your cylinder until it is made hot by the steam.

Be careful not to put in too much oil at any time, knowing, as you do, that it will be sent to the feed-water causing your boiler to prime and foam.

Always *oil up* before starting your engine.

Generally, when you pack the piston packing, both cylinder and packing are cold, and if they are screwed or wedged in very tight while in this condition that the expansion, when exposed to the heat of the steam, will induce great rigidity.

Then the oil or lubricating substance cannot enter between the surfaces in contact, and that great friction, heating and cutting will be the result.

When packing loses its elasticity it is no good, and should be removed.

Piston or valve-rod packing, should never be screwed up more than sufficient to prevent it from leaking, and that the softer the packing the longer it will last and the better your engine will run.

For Steam-Heating of Houses.—To estimate for the steam-heating of dwellings it is safe to allow one square foot of boiler surface for each ten square feet of radiating surface. Small boilers should be larger proportionately than large boilers.

Each horse-power of boiler will supply from 250 to 350 feet of 1-inch conducting pipes, which equals about 80 to 120 square feet of radiating surface.

It is safe to estimate that under ordinary circumstances, one horse-power of boiler capacity will heat about as follows:

15,000 to 20,000 cubic feet in brick buildings in blocks.

10,000 to 15,000 cubic feet in brick stores in blocks.

10,000 to 15,000 cubic feet in brick dwellings, exposed all sides.

7,000 to 10,000 cubic feet in brick mills, shops, etc.

7,000 to 10,000 cubic feet in wooden buildings exposed.

6,000 to 10,000 cubic feet in foundries and wooden shops.

All the joints should be made steam and water tight, as the slightest leak in a steam-heating system is apt to damage furniture, curtains, carpets, etc., if the steam is intended to heat a dwelling. Red or white lead is all right as material to make up joints, but graphite is much better. For gaskets there is nothing better than asbestos.

How to Thaw Out a Frozen Steam-Pipe.—A good way to thaw out a frozen-up steam-pipe, is to take some old cloth, discarded clothes, waste, old carpet, or anything of that kind, and lay on the pipe to be thawed; then get some boiling hot water and pour it on. The cloth will hold the heat on the pipe, and thaw it out in five minutes. This holds good in any kind of a freeze, water-wheel, or anything else.

Steam as a Cleansing Agent.—For cleaning greasy machinery nothing can be found that is more useful than steam. A steam hose attached to the boiler can be made to do better work in a few minutes than any one is able to do in hours of close application. The principal advantages of steam are, that it will penetrate where an instrument will not enter, and where anything else would be ineffectual to accomplish the desired result. Journal boxes with oil cellars will get filthy in time, and are difficult to clean in the ordinary way; but, if they can be removed, or are in a favorable place, so that steam can be used, it is a veritable play-work to rid them of any adhering substance. What is especially satisfactory in the use of steam, is that it does not add to the filth. Water and oil spread the foul matter, and thus make an additional amount of work.

Suggestion for Hot-Water Heating Systems.—Let your "risers" not be less than 1¼″, for smaller pipes soon become coated, if the water used contains lime or other matters in solution or suspension.

Galvanized pipe is best; it does not become rusty and discolor the water.

In ordinary pipe be sure to get "galvanized steam," and not "galvanized gas."

Let your draw-off services be for bath 1″, to lavatories 1″, for hot water ½″. Do not make the "draw-offs" too small; it takes too long to drain a pipe of cold water.

The larger the pipes the freer the circulation, and, if you have hard water, they will remain in good order longer.

Be sure that all joints are secure and free from leaks, and always look through a pipe before fitting it in place, to see that there is no dirt or impediment to the flow of the water through it.

Avoid the use of elbows in circulating pipes, use only bends; if you cannot avoid using an elbow, see that it is a round one.

A Cheap Filter.—A cheap filter which any tinner can make is 12 x 6 inches in size, and 8 inches high. The water flows in near the top, and on the top is a door through which to get into it to clean it. The outlet pipe at the bottom projects 2 inches up on the inside to hold the dirt back. A large sponge is placed inside, which forms the filtering medium, which, of course, can be cleaned as often as desired. The place of the sponge may be taken by powdered charcoal placed in a cotton bag.

TABLES OF MEASURE AND WEIGHT

Linear Measure.

12 inches = 1 foot.
3 feet = 1 yard.
5½ yards }
16½ feet } = 1 rod.
320 rods }
5,280 feet } = 1 mile.
4 rods }
100 links } = 1 chain.

Square Measure.

144 square inches = 1 square foot.
9 square feet = 1 square yard.
30¼ square yards }
272¼ square feet } = 1 square rod.
160 square rods }
10 square chains } = 1 acre.

Cubic Measure.

1,728 cubic inches = 1 cubic foot.
27 cubic feet = 1 cubic yard.
128 cubic feet = 1 cord.
24¾ cubic feet = 1 perch of stone.

Dry Measure.

2 pints = 1 quart.
8 quarts = 1 peck.
4 pecks }
2150.4 cubic inches } = 1 bushel.

Liquid Measure.

4 gills = 1 pint.
2 pints = 1 quart.
4 quarts }
231 cubic inches } = 1 gallon.

Avoirdupois Weight.

16 ounces }
7,000 grains } = 1 pound.
2,000 pounds = 1 ton.
2,240 pounds = 1 long ton.

Troy Weight.

24 grains = 1 pennyweight.
21 pennyweights = 1 ounce.
12 ounces }
5,760 grains } = 1 pound.

Apothecaries' Weight.

20 grains = 1 scruple.
3 scruples = 1 fluid dram.
8 fluid drams = 1 ounce.
12 fluid ounces = 1 pound.

Apothecaries' Measure.

60 minims = 1 fluid dram.
8 fluid drams = 1 ounce.
10 fluid ounces = 1 pint.

Time Measure.

60 seconds = 1 minute.
60 minutes = 1 hour.
24 hours = 1 day.
7 days = 1 week.
365 days = 1 year.
366 days = 1 leap year.

Circular Measure.

60 seconds = 1 minute.
60 minutes = 1 degree.
360 degrees = 1 circle.

English Money.

4 farthings = 1 penny.
12 pennies = 1 shilling.
20 shillings = 1 pound.
21 shillings = 1 guinea.

Surveyors' Linear Measure.

7.92 inches = 1 link.
25 links = 1 rod.
100 links or four rods = 1 chain.
80 chains = 1 mile.

Paper Measure.

24 sheets = 1 quire.
20 quires = 1 ream.
2 reams = 1 bundle.
5 bundles = 1 bale.

NOTES.—The chain (*ch.*), used by surveyors is called Gunter's chain, and consists of 100 links (*l.*). Its length is 792 inches, equal to 66 feet, or 4 rods. Its divisions are decimal, so that chains and links may be written as one number in the same manner as dollars and cents,

Thus, since 35 links equal .35 of a chain, 35 links is written *25.35 chains.*

Any year the number of which is exactly divisible by 4, but not by 100, is a leap year. When the number is divisible exactly by 400 it is also a leap year.

The solar or tropical year has a length of 365 days, 5 hours, 48 minutes, 49.7 seconds.

The Metric System.

1. The Metric System of weights and measures has been legalized in the United States. Its fundamental unit is the meter, from which all the other units of the system are derived. The meter is equal to 30.37 + inches.

2. The meter is defined as the ten-millionth part of the distance from the Equator to the North Pole, measured on the meridian passing through Paris. Later measurements have shown that the meter does not exactly correspond with the length required by the definition.

3. The principal point of superiority of the metric measures is in their decimal scale. As in the case of United States money, several denominations may be written together as one number. Thus, 9 Mm. 7 Km. 5 Hm. 3 Dm. 8 m. 4 dm. 6 cm. 5 mm. may be written as one denomination: 97538465 mm., or 9753846.5 cm., or 97538.465 m., or 9.7538465 Mm., etc. Reduction ascending and reduction descending thus become a mere matter of moving the decimal point.

Metric Measures.

10 millimeters (*mm.*) = 1 centimeter, . . . *cm.*
10 centimeters = 1 decimeter, . . . *dm*,
10 decimeters = 1 meter, ... *m.*
10 meters = 1 dekameter, . . . *Dm.*
10 dekameters = 1 hektometer, . . *Hm*
10 hektometers = 1 kilometer, . . . *Km.*
10 kilometers = 1 myriameter, . . *Mm*

Metric Square Measure.

100 sq. millemeters = 1 sq. centimeter,
100 sq. centimeters = 1 sq. decimeter,
100 sq. decimeters = 1 sq. meter,
100 sq. meters = 1 sq. dekameter,
100 sq. dekameters = 1 sq. hektometer,
100 sq. hektometers = 1 sq. kilometer.

NOTE.—The principal unit is the square meter, equal to 1.196 sq. yds.

Metric Land Measure.

100 centares (*ca.*) = 1 are, ... *a.*
100 ares = 1 hectare, ... *Ha.*

NOTE.—The *are*, equal to a square dekameter, or 100 square meters, is 119.6 square yards, very nearly. The *hektare* is equal to 2.471 acres.

Metric Cubic Measure.

1000 cubic millimeters = 1 cubic centimeter,
1000 cubic centimeters = 1 cubic decimeter,
1000 cubic decimeters = 1 cubic meter.

NOTE.—The *cubic meter* is equal to 35.3166 cubic feet. When used to measure *wood* or *stone*, it is called a *stere* (pronounced *stair*). Ten *steres*, called a *dekastere*, are equal to 2.759 cords.

Metric Capacity Measure.

10 milliliters (*ml.*) = 1 centiliter, (*cl.*)
10 centiliters = 1 deciliter, (*dl.*)
10 deciliters = 1 liter, (*l.*)
10 liters = 1 dekaliter, (*Dl.*)
10 dekaliters = 1 hektoliter, (*Hl.*)
10 hektoliters = 1 kiloliter, (*Kl.*)

The *liter*, (*l.*), equal to a cubic decimeter, is 61.028 cubic inches, 2.1135 pints, or 33.816 fluid ounces. The unit of measure for small quantities of liquids, as in mixing medicines and in philosophical experiments, is the milliliter, equal to 16.23 minims.

A gallon is equal to 5.785 *l.*, and 2.8375 bush. make a *Hl.*

Metric Weight.

10 milligrams (*mg.*) = 1 centigram, (*cg.*)
10 centigrams = 1 decigram, (*dg.*)
10 decigrams = 1 gram, (*g.*)
10 grams = 1 dekagram, (*Dg.*)
10 dekagrams = 1 hektogram, (*Hg.*)
10 hektograms = 1 kilogram or kilo, *Kg.*
1000 kilos = 1 tonne, (*T.*)

NOTE 1.—The *gram* is equal to 15.4323 grains, the *kilo* to 2.2046 lb. avoirdupois, and the *tonne* to 2204.6 lb. avoirdupois. *Tonne* is rarely used, the number of *kilos* being preferable.

The weight of one *cubic centimeter* of pure water at its greatest density (39.2° Fahrenheit) is a *gram*; the weight of a *cubic decimeter*, or a *liter*, of water at the same temperature is a *kilogram*, or a *kilo*, and the weight of a cubic meter of water is a *tonne*.

The original 5-cent nickel weighs 5 grams, and is 2 centimeters in diameter.

Equivalents.

Metre = 39.37 inches (3¼ ft. nearly).
Kilometre = .62138 mile (⅝ nearly).
Square metre = 1.196 square yards (1 1-5 nearly).
Cubic metre = 1.308 cubic yards (1 1-3 nearly).
Litre = 1 cu. dm.
= 1.0567 liquid quarts (1 nearly).
= .908 dry quart (.9 nearly).
Kilogram = The weight of 1 cu. dm. of water at 29.2 Fah.
= 2.2046 pounds av. (2 1-5 nearly).
Hektare = 10,000 sq. m.
= 2.471 acres (2½ nearly).
Stere = 1 cu. m.
= .2759 cord (3-11 nearly).

Miscellaneous Tables.

Linear Measures.

3 barley-corns, or sizes = 1 inch. Used by shoemakers.
4 inches = 1 hand. Used to measure the height of horses at the shoulder.
21.888 inches = 1 sacred cubit.
6 feet = 1 fathom. Used to measure depths at sea.
3 feet = 1 pace.
1.152⅔ common miles = 1 geog. mi. Used to measure distances at sea.
3 geographic miles = 1 league.

Book Measure.

A sheet folded into	*The book is*	*A sheet of paper makes*
2 leaves	a folio,	4 pp. (pages)
4 "	a quarto or 4to,	8 "
8 "	an octavo or 8vo,	16 "
12 "	a duodecimo or 12mo,	24 "
16 "	a 16mo,	32 "
18 "	an 18mo,	36 "

The weight of a bushel of certain articles is as follows:

Barley,	48 lb.	Hemp seed,	44 lb.
Beans,	60 "	Oats,	32 "
Buckwheat,	42 "	Onions,	60 "
Bran,	20 "	Peas,	60 "
Corn,	56 "	Potatoes,	60 "
Corn meal,	50 "	Rye,	56 "
Corn in ear,	68 "	Salt,	56 "
Clover seed,	60 "	Timothy seed,	45 "
Flax seed,	56 "	Wheat,	60 "

Miscellaneous Weights and Measures.

100 lb. of grain or flour = 1 cental.
100 " dry fish = 1 quintal.
100 lb. of nails = 1 keg
196 " flour = 1 barrel.
200 " beef or pork = 1 barrel.
240 " lime = 1 cask.
280 " salt at N. Y. Salt Works = 1 barrel.
Keg powder, = 25 pounds.
Stone of lead or iron = 14 pounds.
Pig " " = 21½ stone.

Anthracite coal, broken, cubic foot averages 54 lbs.

A ton, loose, occupies 40 to 43 cubic feet.

Bituminous coal, broken, cub. ft. averages 49 lbs.

A ton, loose, occupies 40 to 43 ft.

Cement (Hy.) Rosendale, Bush. = 70 lbs.
" " Louisville, " = 62 "
" " Portland, " = 96 "
Gypsum, ground, " = 70 "
Lime, loose, " = 70 "
" well shaken, " = 80 "
Sand at 98 lbs. per cu. ft. " = 122½ "
18.29 bush. = ton 1.181 ton = cu. yd.
A cable's length = 240 yards.
20 articles = 1 score.
12 dozen = 1 gross.
12 gross = 1 great gross.
A cord of wood = 128 cubic feet.
1 hand = 4 inches.
1 span = 9 inches.

Shoemaker's Measure.

No. 1, of small size is 4⅛ inches long.

No. 1, of large size is 8 11-24 inches long.

Each succeeding number of either size is ⅓ of an inch additional length.

60 pairs of shoes = 1 case.

An American Car Load

Of 20,000 lbs. would contain the following articles: 70 bbl. salt. 70 of lime. 90 of flour. 70 of whiskey. 200 sacks of flour. 6 cords of soft wood. 15 to 20 head of cattle. 50 to 60 head of hogs. 80 to 100 head of sheep. 6000 feet of solid boards. 340 bush. of wheat. 400 of corn. 680 of oats. 400 of barley. 360 of flaxseed. 360 of apples. 430 of Irish potatoes. 300 of sweet potatoes. 100 of bran. 130 to 190 barrels of eggs. 15,000 to 26,000 lbs. of butter. 200 kegs of nails.

On roads, with track in best condition, a car load is from 24,000 to 60,000 lbs.

Miscellaneous Equivalents.

231 cu. in. = 1 gal. liquid measure.
268 4-5 " = 1 gal. dry measure.
277.274 " = 1 imperial gal. of Great Britain.
2150.42 " = 1 bushel of U. S.
2216.192 " = 1 " " Great Britain.
2747.7 " = 1 heaped bushel
1000 oz. or 62½ lb. = 1 cu. ft. of pure water.
8 1-3 lb. pure water = 1 gallon.
5760 grains = 1 lb. Troy or apothecaries'.
7000 " = 1 " avoirdupois.
24.75 cu. ft. = 1 perch of masonry.
36 to 45 cu. ft. = 1 ton anthracite coal.

Bible Weights and Measures.

A day's journey	=	33 1-5 U. S. miles.
A Sabbath-day's journey	=	1 " mile
Ezekiel's reed	=	11 feet nearly.
Cubit—Hebrew	=	22 inches, nearly.
" Greek	=	18 " about.
A finger's breadth	=	1 inch, "
A shekel of silver	=	62½ cents.
A " gold	=	$8.09.
A talent of silver	=	$1,518.32.
" gold	=	$23,309.
A piece of silver	=	13 cents.
A farthing	=	3 "
A gerah	=	2½ "
A mite	=	1½ mills.
A homer (as dry measure)	=	11 1-9 bushels.
A " (" liquid ")	=	70 gallons and 5 pints.
An ephah or bath	=	7 " " 4 "
A bin	=	1 gallon " 2 "
A firkin	=	7 "
An omer	=	6 "
A cab	=	3 "
A log	=	¾ "

Capacity of Cylindrical Cisterns.

The following table shows the capacity in gallons for one foot in depth of cylindrical cisterns of any dimensions. Find the diameter of any given cistern and multiply the number of gallons for one foot by the depth of the cistern, and you will have its volume in gallons:

Diameter.	Gallons.	Diameter.	Gallons.
2 feet	19	6½ feet	206
2½ feet	30	7 feet	239
3 feet	44	8 feet	313
4 feet	78	9 feet	396
4½ feet	99	10 feet	489
5 feet	122	11 feet	592
6 feet	176	12 feet	705

Mensuration; or, Useful Rules for Computing Measurements.

Area of a triangle = base × ½ altitude.
Area of a parallelogram, multiply base by altitude.
Area of a trapezoid = altitude × ½ the sum of parallel sides.
Area of a trapezium = divide into two triangles and find area of the triangles.
Circumference of circle = diameter × 3.1416.
Diameter of circle = cicumference × .3183.
Area of circle = square of the diameter multiplied by .7854.
Area of circular ring = diameters of the two circles × difference of diameter and that product by .7854.
Side of square that shall equal area of circle = diameter × .8812 or circumference × .2821.
Diameter of circle that shall contain area of a given square = side of square × 1.1284.
Surface of cylinder or prism = area of both ends + length × circumference.
Contents of cylinder or prism = area of end × length.
Surface of sphere = diameter × circumference.
Contents of sphere = diameter^3 × .5236.
Contents of pyramid or cone = area of base × ⅓ altitude.
Surface of frustum of cone or pyramid = sum of circumference at both ends × slant height + area of both ends.
Contents of frustrum of cone or pyramid = multiply areas of two ends together and extract square root. Add to this root the two areas and × ⅓ altitude.
Contents of a wedge = area of base × ½ altitude.

Lumber and its Measurement.

A board foot is 1 foot long, 1 foot wide, and 1 inch thick, and is used as the unit of measurement.

What is called *scantling lumber* is 3 or 4 inches wide, and from 2 to 4 inches thick. *Joist* is usually narrow and deep. When lumber is heavier than joist or scantling it is called *timber*. Thick boards are called *planks*. The usual outside covering of wooden houses is *siding*.

If lumber is less than 1 inch in thickness it is considered as inch in computing the measurement. But a fraction greater than a half-inch is called an inch, and if less than a half it is rejected. A board 4 5-6 inches wide would be considered as 5 inches.

A board 16 feet long, 12 inches wide, and 1 inch thick would contain (16 × 12 × 1) ÷ 12, or 16 feet. A board 12 feet long, 14 inches wide, and 3 inches thick, would contain (12 × 14 × 3) ÷ 12, or 42 feet, board measure.

To find the number of board feet in any pile of lumber: Multiply the length in feet by breadth in feet and by thickness in inches, and the result by number of boards.

To Compute Volume of Square Timber.

When all the dimensions are in feet:

Rule. Multiply the breadth by the depth and that product by the length, and the product will give the volume in cubic feet.

When either of the dimensions are in inches:

Rule. Multiply the length, breadth and depth and divide by 12.

When any two of the dimensions are in inches:

Rule. Multiply the length, breadth and depth and divide by 144.

To Measure Round Timber take the girth in inches at both the large and small ends, add them, divide by two, which gives the mean girth; then multiply the length in feet by the square of one-fourth of the mean girth, and the quotient will be the contents in cubic feet. This rule is commonly adopted, and gives four-fifths of the true contents, one-fifth being allowed to the purchaser for waste in sawing.

THE WORLD OF SCIENCE

WHAT INTERESTS THE WORKER IN WOOD—IN METALS AND MINERALS—ELECTRICITY AND ITS WONDERFUL POSSIBILITIES—HEAT, ITS LAWS AND MANIFESTATIONS—STEAM AND ITS APPLICATION—OTHER SCIENCES OF EVERY-DAY INTEREST AND APPLICATION

SCIENCE AS APPLIED IN PRACTICE

Science is a word which by many is not very well understood, and of which a brief definition may be here advisable. It is often wrongly applied, and its use is in general very loose. Science means knowledge; but this knowledge is of the works of God; not of those of man; of the forms and forces among which we are born, not of those which our own hands have made. The latter is the domain of useful art, not of science. The study of the nature of electricity is science; the use of the electric current in telegraphing is art. The study of the formation of coal or iron is science; the employment of coal and iron in manufacture is art. And so with a thousand other cases that might be given.

In our times it is not easy to talk about science without thinking of the many uses which man makes of scientific facts and principles. When we speak of light or electricity for instance, we are very apt to think of the telescope or the mirror, the telegraph or the electric light. It is these applications of science in which practical men are most interested, and as this is a book for the use of practical men we propose to confine ourselves largely to the benefit which the facts of science confer upon man. In the present chapter we shall talk about the production and working of wood and metal and some other products of the earth.

Forests of the Earth.

Ages before the vast coal deposits came into use as sources of fuel, wood served man for the purposes of heating and cooking, and its use was very general until within the nineteenth century. It is still widely used for household purposes, though in modern cities coal has largely taken its place, and wood is now rarely employed as a fuel in manufactories.

Though civilization has been lavish in its destruction of forests, the breadth of the woodland still remaining upon the earth is enormous. In the Eastern Hemisphere Russia possesses a vast extent of forest land, stretching widely through European Russia and over an immense region in Siberia. Africa contains mighty forests, one of which it took Stanley several months to cross. But of all the earth America is the richest in timber. Through North and South America alike vast forests extend. In South America the immense valley of the Amazon, one third of the whole continent, is one mighty unbroken forest. In North America also the forests are of vast extent, though the axe and the firebrand are rapidly robbing the United States of its trees.

United States Lumber Product.

The total area of forest lands in the United States and Territories, according to annual report of the Division of Forestry of the Department of Agriculture, is 465,795,000 acres. The State which has the largest share is Texas, which is credited with 40,000,000 acres. Minnesota comes next with 30,000,000, then Arkansas with 28,000,000; and Florida, Oregon, California and Washington State are put down at 20,000,000 each. Georgia and North Carolina have each 18,000,000; Wisconsin and Alabama, each 17,000,000; Tennessee, 16,000,000; Michigan, 14,000.000; and Maine, 2,000,000 acres. Taking the States in groups, the six New England States have, in round numbers, 19,000,000 acres; four Middle States, 18,000,000; nine Western States, 80,000,000; four Pacific States, 53,000,000; and fourteen Southern States, 233,000,000 acres; the last being almost precisely half of the forest area of the country. The Territories are credited with 63,000,000 acres. The estimate of the division of Forestry for 1900 makes the forest area 699,500,000 acres.

The total annual cut in this vast area of forest approximates 24,000,000,000 cubic feet, of which about three-fourths, or 18,000,000,000 feet are used for fuel, 5,000,000,000 feet for building and manufacturing lumber and the remaining 1,000,000,000 feet for fencing, railroad ties, mine timbers, charcoal, and other purposes.

This immense drain upon the forests of the United States is not the whole. Every year fires make great inroads into the woodland area, in many regions more timber falling by fire than by the axe. The average annual money loss by fire is probably as much as $20,000,000. The value of the total annual product of our forests was estimated by the 1890 Census at $1,038,616,947. It is now probably much greater.

Forest Preservation.

The destruction of the forests is very injurious to human interests, since it has a serious effect on the fall and flow of rainwater. The forest bed holds the water and yields it slowly to the streams. In a deforested country the water pours down and swells the streams to torrents in the rainy season, while they shrink into narrow channels in times of drought. Forests are thus great regulators of the water supply. This has long been perceived in Europe, where active efforts have long been made to restore the trees to the mountains and hill slopes. It has only recently been perceived in the United States, where efforts at forest preservation are of late origin. What has been accomplished may be briefly stated.

For the preservation of the forests, the State of New York first instituted a Forest Commission in 1885. Several radical changes have been made in the law, which now provides for a "Commission of Fisheries, Game, and Forests," to which is delegated the enforcement of the fish and game laws, the care of the Adirondack Park, and the State Forest Preserve. The Legislature of 1897 authorized the purchase of lands in the Adirondacks as an addition to the Park and Forest Reserve to the amount of $1,000,000, to which $500,000 in 1898 and $300,000 in 1899 have since been added. A State College of Forestry has been opened at Cornell University, and has charge of 30,000 acres of State land as a demonstration forest in the Adirondacks. Better methods of handling spruce lands have been introduced on 100,000 acres of private forests, under the direction of the Division of Forestry, U. S. Department of Agriculture. The States of Kansas, Michigan, Minnesota, Maine, New Hampshire, Pennsylvania, and Wisconsin also have special commissions under their forestry laws. The Pennsylvania Legislature of 1897 provided for the purchase of three forest reserves of not less than 40,000 acres each, and the Wisconsin Assembly appointed a commission to formulate and recommend forest legislation. Minnesota has probably the best forest fire law of any State, with a Chief Fire Warden as executive officer. In New Jersey and North Carolina the Geological Survey is specially charged with forest interests.

A national organization known as the American Forestry Association, composed of delegates from the States, meets annually. Local or State Associations have been formed in California, Connecticut, Colorado, Ohio, New York, Pennsylvania, Kentucky, Massachusetts, Indiana, North Carolina, South Carolina, Washington, Minnesota, Texas, Utah, North Dakota, Wisconsin and New Jersey.

By Act of Congress March 3, 1891, the President was authorized to make public forest reservations. Seventeen such, comprising 17,968,440 acres, were established in Colorado, New Mexico, California, Arizona, Wyoming, Oregon, and Washington, previous to 1897. On February 22, 1897, President Cleveland proclaimed thirteen additional reserves, with a total area of 25,683,840 acres.

Since then, under an Act of Congress of March 1, 1898, extensive additional areas have been reserved in Arizona, New Mexico, South Dakota, Montana, Utah, Wyoming, and California, and the grand total of the forest reservations reached on January 1, 1901, the great area of 46,828,449 acres, there being at that date thirty-nine reservations. In addition, many States now offer a reward for the planting of trees. This is especially the case in some of the prairie States of the West, as Kansas, Nebraska, and Iowa, and vast numbers of trees have been planted. Arbor Days have also been established in nearly all the States of the Union, forming public holidays for tree-planting, school children being especially encouraged in this important duty. As may be seen from the above, the new age of forest preservation has fairly begun in the United States.

Useful Trees.

The earth possesses a very great number of different woods which man can utilize. In the United States there are more than 300 species of trees of a height of thirty feet and over. South America has a much greater number, and India alone possesses about 900 species of timber trees. But many of these are rare, and comparatively few species are used in the arts.

Chief among the American timber trees stands the White Pine (*Pinus strobus*), an easily worked and very useful wood. This was formerly very abundant, but has been cut so lavishly, without replanting, that the forests of the East are largely exhausted, and the vast pineries of Michigan and Wisconsin are rapidly vanishing before the axe and the sawmill. Other trees of importance are the Yellow Pine, the Hemlock, the Black Spruce, the Cedar, Cypress, and Cottonwood of the East and South, the Great Douglas Pine and Redwood of the Pacific States, one or two species of Oak, and various others. Among the varieties of hardwood timber used for furniture, the Black Walnut has long stood at the head, but this has largely disappeared, and several species of light-colored wood, such as Oak, Maple, and others, are taking its place.

Ornamental Woods.

Outside the United States, and especially in the tropics, there are numerous species of valuable ornamental woods. Most important of these is the Mahogany of the American tropics, a close-grained, easily worked hardwood, of rich dark color, taking a fine polish, and very durable. Brazilian Rosewood is a strong, hard, and heavy wood, of a rich dark-brown color, with beautiful streaks and cloud-like markings, which give it a resemblance to colored marble. It has long been in use for costly furniture. Satinwood is something like it in hardness and fineness of grain, but is of much lighter color, being of a glossy yellow tint. Ebony, another costly cabinet wood, is very hard and heavy, and deep black in color. Inlaid with ivory or other light substance, it has been a favorite for several thousand years for ornamental purposes.

Among the very beautiful woods used only for veneering and inlaying are the Tulip-wood, Snake or Letter-wood, Purple-heart, and Zebra-wood, from the American tropics; Amboyna-wood, from Singapore; the American Bird's-eye Maple, and others. Of all woods Lignum Vitæ comes nearest to a strong metal in its resistance to wear and tear.

For ship-building oak has long been a favorite wood, and is still largely used, though it has the defect of rusting iron which is in contact with it. The East Indian teak comes next to it in value, and is unlike oak in its action upon iron, which it protects from rust. This gives it great value as a backing for iron-plating. Elm is also of value for the under-water parts of ships, it being very durable both when kept quite dry and when constantly wet.

Useful Trees of the Philippine Islands.

The Philippine Islands, now possessions of the United States, are exceedingly rich in valuable timber trees, more than 200 kinds having been officially tested in the Manila arsenal. Among these are no less than fifty varieties of hardwood lumber, of which only a few have been used outside the islands. Chief among these is the teak-like Molave, a heavy brown timber, almost as hard as steel, and of great strength. It resists the action of water for years, is proof against the destructive white ant, and is used for all purposes. Its firm surface admits of fine carving. Two other trees, the Ipil and the Yacul, resist the white ant (a very valuable property in the tropics), and there are various handsome woods suitable for fine furniture. The Bansalque, or bullet-tree, yields a wood of such iron-like hardness that it can be driven like a nail. These woods vary in color from the jet-black Ebony to the light-hued Cedar, two of very ornamental color being the Mabola (black streaked with yellow) and the Malatapay (black striped with red). Cuba, our near neighbor, has also many fine cabinet woods, more than forty in all, including Mahogany, Ebony, Lignum Vitæ, and others; also Logwood, Ironwood, and many species of palms.

The Lumbering Industry.

Everywhere the method of the lumberman is to saw the timber into logs where it is felled, and haul it or float it to the sawmill, where it is cut into boards, scantling, shingles, and other merchantable forms. In Maine and Nova Scotia the logs are floated down the streams in drives, and sometimes made into great rafts and towed down the coast. The logs in winter are loaded on great sledges and hauled to the streams. But the extension of railroads has greatly changed those primitive methods, and much of the timber is now transported on cars.

In the lake region of the West the sawmill follows the receding forest, cutting the timber into merchantable sizes as it goes. The felled tree is sawed into lengths of 32 feet if small, and 16 feet if large, and hauled to the mill, or to the streams or railroads, by the use of "big wheels," of 10 to 12 feet diameter. In many sections it is the custom to lay a double row of smooth logs and grease their upper surfaces. Along this slippery track logs are easily hauled by horses, with little danger of leaving the path.

Seasoning Timber.

Timber, when freshly cut, contains from thirty-seven to forty-eight per cent. of water, the kind, the age, and the season of vegetation governing the percentage. Older wood is generally heavier than young wood, and the weight of wood cut in the active season is greater than that of wood cut in the dormant season. Water in wood is not chemically combined with the fiber, and, when exposed to the atmosphere, the moisture evaporates. The wood becomes lighter until a certain point is reached in the drying out process, after which it gains or loses in the weight according to the variations in the moisture and temperature of the atmosphere. Following is a table showing the percentage in weight of water in round woods from young trees at different lengths of time after cutting:

Kind of Wood.	6 mos.	12 mos.	18 mos.	24 mos.
Beech	30.44	23.46	18.60	19 95
Oak	32.71	26.74	23.25	20.28
Hornbeam . . .	27.19	23.08	20.00	18.59
Birch	39.72	29.01	22.73	19.52
Poplar	40.45	26.22	17.77	17.92
Fir	33.78	16.87	15.21	18.00
Pine	41.70	18.67	15.63	17.42

According to these figures, taken from actual trials, there is nothing gained by keeping wood longer than eighteen months, so far as drying or seasoning is concerned. In the woods mentioned, there appears to be an actual loss in some, and only a slow gain in others after that length of time. The pine, fir, and beech gained moisture, and the others in the list lost only very slightly after the eighteen months had passed.

Trees, especially deciduous trees, should always be felled in winter, the season in which they contain the least sap. They should not be left long upon the ground where they have fallen, but as soon as possible the logs should be stacked, with packing pieces between them, so as to allow the sap to evaporate during which time they need to be covered from the weather. When cut into planks or boards these are laid horizontally, separated by laths, protected from rain, and left to dry for six months. They should then be placed upright upon racks, slightly separated and left for as long a time. For natural seasoning most ordinary timber need this length of time, though some dry more quickly than others. This is much the best method of seasoning, but the work is now often hastened by steaming or boiling, or in the case of thin cut wood by placing it in hot-air chambers. Very frequently the process of seasoning is only partly completed and the wood sent to market unfit for use. In the case of cabinet and fine joining work the seasoned wood is commonly, just before using, put for a week or ten days into a stove heated to about 120° F.

The Annual Rings in Trees.

The annual rings in trees exist as such in all timber grown in the temperate zone. Their structure is so different in different groups of timber that, from their appearance alone, the quality of the timber may be judged to some extent. For this purpose the absolute width of the rings, the regularity in width from year to year, and the proportion of spring wood to autumn wood must be taken into account. Spring wood is characterized by less substantial elements, the vessels of thin-walled cells being in greater abundance, while autumn wood is formed of cells with thicker walls, which appear darker in color. In conifers and deciduous trees the annual rings are very distinct, while in trees like the birch, linden and maple the distinction is not so marked, because the vessels are more evenly distributed. Sometimes the gradual change in appearance of the annual ring from spring to autumn wood, which is due to the difference in its component elements, is interrupted in such a manner that a more or less pronounced layer of autumn wood can apparently be recognized, which again gradually changes to spring or summer wood, and then gradually finishes with the regular autumn wood. This irregularity may occur even more than once in the same ring, and this has led to the notion that the annual rings are not a true indication of age; but the double or counterfeit rings can be distinguished by a practiced eye with the aid of a magnifying glass. These irregularities are due to some interruption of the functions of the tree, caused by defoliation, extreme climatic condition or sudden changes of temperature. The breadth of the rings depends on the length of the period of vegetation; also when the soil is deep and rich, and light has much influence on the tree, the rings will be broader. The amount of light, and the consequent development of foliage, is perhaps the most powerful factor in wood formation, and it is upon the proper use of this that the forester depends for his means of regulating the development and quantity of his crop.

The Many Uses of Wood.

Wood shares with iron the honor of being one of the most useful products which nature has provided for man. In early times it was the one great servant of the human race. Before coal was known it was the only fuel, and before iron was known it served man for almost every purpose of life. Taking the whole world, it is still the chief fuel, and even in the United States, where coal is so plentiful, and wood has so many other uses, three-fourths the annual product is consumed in the stove.

For ages wood has been the great building material, the mainstay of the carpenter and the architect. Man has lived in wooden houses, crossed the streams on bridges of wood, inclosed his fields with wooden fences, put to sea in wooden ships, built his carriages and cars of wood, used wood for the furniture of his dwellings, the handles of his tools, the framework of his machines, and for various other purposes, among which we must include the finest cabinet and ornamental work. The great growth of the railroad system has developed a new use for wood in the building of passenger and freight cars and the innumerable ties to which the rails are fastened, while the telegraph pole has become another great consumer of the forest product.

Of late years iron has come into close competition with wood. The growing scarcity of wood, the increasing cheapness of iron, are leading causes of this, and we are now in the age of iron buildings, iron bridges, iron ships, and wire fencing, while even railroad cars are being made of sheet steel. Efforts have been made to find a substitute for wood in railroad ties, even glass being suggested, but as yet without satisfactory result.

But while wood has been removed from many of its old duties, new ones have arisen which are consuming it with great rapidity. One of these is the wood pavement, which, however, has made no great progress. The common lead-pencil seems a thing of small importance, yet it has made serious havoc in our cedar groves. The best wood in the world for this purpose is a soft, close-grained cedar which grows along the coast of Florida, and which is used in great quantities both in America and Europe for inclosing the black lead of the pencil. Another small article which consumes no small quantity of the forest product is the common friction match. In this little household treasure many tons of wood are daily burned to ashes. There is a single English factory which makes thirty-six billions of matches yearly, and at the Chicago Fair of 1893 there were shown German match machines that would cut fifteen million splints a day. Europe consumes about 1200 tons of phosphorus in matches every year, and it is said that in some nations 700 matches are used yearly for every inhabitant. Of all nations, the United States is the greatest consumer of matches.

The Manufacture of Wood Paper.

Of all the new uses of wood its employment in paper-making stands at the head. The making of wood-pulp is one of the great inventions of the nineteenth century, and the applications of this material are growing at so rapid a rate that in the time to come they may go far to exhaust the forests of the world. Its great use is in paper-making. The modern newspaper and book are eating into the forests like a conflagration. When it is considered that more than 20,000 different newspapers are published in the United States alone, some of them of great size and with a daily issue of from one to several hundred thousand copies, that there are magazines of equally great circulation, and that of the myriad of books now issued some of them reach more than a half million copies, we may comprehend the vast demand which the reader makes upon the forest.

In the manufacture of wood-pulp veinous trees are employed, the spruce in particular, on account of its cheapness and its adhesive gum. There are two modes of manufacture, known as the ground or mechanical, and the chemical wood-pulp. Ground pulp is made by pressing the logs against emery wheels or grindstones revolving swiftly under water. The wood is thus reduced to a fine wet saw-dust, which needs to be mixed with a portion of chemical pulp or other fibrous material to enable it to hold together. The paper made from this pulp is cheap but poor, and is mainly used for newspapers and cheap wrapping papers.

Chemical Wood-Pulp.

In the making of chemical wood-pulp, both spruce and poplar are commonly used. Logs with few knots are preferably chosen, sawed into lengths of about four feet, and cut in fine slices by a chipping machine. These are then placed in great tanks, or digesters, caustic soda ash being added to the water if poplar is used, and bi-sulphite of lime for spruce. Then live steam is introduced under about 110 pounds pressure, and boiling is kept up for eight or ten hours. The liquor is next washed out, and the pulp converted into paper on the usual paper-machine.

Book and magazine papers are now made almost wholly from chemical wood-pulp, the old rag-paper being quite insufficient in quantity, and used principally for the higher grades of paper. But the use of wood-pulp is not confined to paper-making. It is coming into use as a substitute for wood or tin in dozens of common articles, including basins, plates, pails, and other small wares. One of its uses is in the making of car wheels, the pulp being forced in under great pressure between the rim, hub, and side-plates. It reduces the vibration of the wheel and thus makes it more durable. Wood-pulp bricks have been manufactured, the pulp being chemically treated and moulded under a pressure of 2,000 pounds to the square inch. The bricks thus made are cheap, tough, and solid. Pipes and drain-tiles are made by a similar process, and even barrels are now made of wood-pulp. Another strange use for this serviceable material is in the manufacture of telegraph poles. These are made in the form of hollow tubes, and are strong and more sightly than the usual crooked poles.

Coffins have been made of wood-pulp, so that the grave itself is invaded by this new material. In fact, there is no end of the articles which may be made from it. One of the most remarkable of them is an excellent substitute for silk, in which the pulp is forced by heavy pressure through minute holes in a metal plate, issuing in fine silky threads closely resembling those of the spider itself. Another modern use of wood is the extraction from it, by chemical means, of cellulose, a substance which forms the principal mass of the cell-membranes of all plants. A homogeneous form of this substance is produced by treating it with nitric acid, yielding the powerful explosive known as nitro-cellulose, or gun-cotton. This, dissolved in alcohol and ether, yields the collodion which is so largely used in photography. In 1870 it was found that gun-cotton could be dissolved in melted gum-camphor, yielding a body solid at ordinary temperatures and possessing remarkable properties. This, under the name of celluloid, is made into numerous articles, such as collars, cuffs, artificial teeth, cutlery handles, billiard balls, imitation coral, ivory, tortoise-shell, agate, etc. The Japanese imitate ivory with it so perfectly that it is not easy to distinguish their carved celluloid from actual ivory.

SCIENCE IN THE USE OF METALS

The most desired of the metals is gold; the most important is iron. It is the most abundant and the most useful. Man owes his civilization to iron. Before it was known he was a savage using weapons and tools of stone. The first steps in civilization were made after bronze was discovered, but all the higher stages belong to what is called the Iron Age. This is due to the fact of the great abundance of this metal, the ease with which it can be wrought into tools and machines, its hardness and toughness. If we add to iron about 1.5 per cent. of carbon, it is converted into the very hard substance called steel, which of old was largely used in making the weapons of war, but is now employed for so many purposes that we might justly call this the Age of Steel.

Iron and Its Ores.

Iron ore is found in great abundance in very many parts of the earth. Some of the substances which man uses, such as coal, may in a few centuries be exhausted; but iron is inexhaustible. The United States possesses it in vast quantities. It is found throughout the whole Appalachian mountain system, with its length of over 1000 miles, and its average breadth of seventy miles, and is very rich in Pennsylvania, West Virginia, Georgia and Alabama. It is abundant in the Lake Superior region, and forms whole mountains in Missouri. There is an immense bed of manganese ore in Arkansas; Wyoming possesses iron enough to supply the world, and there are large deposits of this useful metal in other States.

Iron ore consists of oxide of iron. The most abundant ores are Hematite, or Red Oxide (Fe_2O_3) and Magnetite, or Black Oxide (Fe_3O_4). Other ores of considerable importance are Iron Pyrites, or bisulphide of iron, spathic ore, or carbonate of iron, brown iron ore, which contains brown and yellow ochres, and bog-iron ore, of which there are immense beds on Puget Sound, Washington. These ores are reduced by the use of heat, which drives off the oxygen, melts the iron, and allows it to be drawn off in the liquid state from the impurities. These are also melted, and are drawn off separate from the iron, hardening into a glassy material called slag.

Coal is used to melt the iron, so that under present circumstances the quantity of iron produced is largely dependent upon the coal. In the United States, as a rule, the great beds of coal and iron occur close together, a fact of great advantage. This is particularly the case in Pennsylvania and Georgia.

Production of Iron.

The United States is now the greatest iron-producing country in the world. Great Britain, which was in the lead as late as 1894, produced, in 1900, 8,700,000 tons of pig-iron and Germany about 8,000,000 tons, while the United States produced, in round numbers, 13,000,000 tons. This is over one-third of the world's production, which is about 36,000,000 tons. Of this total product two-thirds, or nearly 24,000,000 tons, is now converted into steel. This is a much larger proportion than existed a few years ago, for steel is now used for many purposes in which iron was formerly employed. The steel product of the United States in 1900 was 10,600,000 tons, more than double that of Great Britain.

Coal Production.

As coal is so closely related to iron, it is important here to state the quantity produced of this indispensable fuel. The coal fields of the world, as at present known, are enormous. Those of China and Japan are estimated to cover 200,000 square miles; of the United States, 194,000; of India, 35,000; of Russia, 27,000; of Great Britain, 9,000; of Germany, 3,600; of France, 1,800; and of other countries, 1,400. This yields a total of 471,800 square miles, but says nothing of the continent of Africa, and of the American continents apart from the United States, the extent of whose coal fields is not known, but may prove very considerable.

Great Britain and the United States are the great coal producers, the annual product of each being about 200,000,000 tons. But the United States product is yearly growing, while that of Great Britain is at its topmost level, and must soon decrease, as many of its mines are nearly worked out. The remainder of the world yields about 170,000,000 tons, without counting China, whose production is unknown. Of the two varieties of coal, bituminous and anthracite, the production of the latter is nearly confined to Pennsylvania, which yields over 50,000,000 tons annually. There are said to be immense beds of anthracite coal in China, of which little is produced, since it is mined by the pick and carried to market on muleback.

Bessemer Steel.

The greatly increased use of steel is due to the cheapness of its production by the Bessemer process. In this process a great crucible lined with fire-clay, called a converter, is used. The melted pig-iron, which contains carbon and silicon, is run into the converter, and a blast of air under pressure is driven through it. The result is that the silicon and some other impurities are burned out, and also most of the carbon, just enough carbon being left to convert the pig-iron into steel. If the carbon is too greatly reduced, malleable or wrought-iron results.

Steel was formerly made by first producing wrought-iron, and then adding the necessary quantity of carbon. This was an expensive process, but steel is now made so cheaply that it is replacing iron for railroad bars, and many other purposes. Steel which is low in carbon is called soft or mild steel, and is more easily worked than hard steel. It is used for buildings, bridges, and other structures, hard steel being used for tools.

The casting of steel is a recent process, which has greatly developed of late years. At first steel castings were full of pores, but this has now been overcome, and solid castings are produced for many purposes. One important use of steel is in the making of armor-plates for naval vessels. These were at first made of iron, but soft-steel castings began to be made for them about 1886. In the manufacture of modern armor-plates the steel billets are subjected in a heated state to a hydraulic pressure of some 7,000 pounds per square inch. This is to squeeze out all pores, condense the steel and make it solid throughout.

Great toughness is needed in armor-plates to enable them to resist the impact of shells from modern rifled cannon. It has been found that the addition of from two to four per cent. of nickel adds greatly to the resisting powers of the steel. In addition to this, processes of surface hardening are employed. What are known as Harveyized plates, are surface-hardened plates of nickel steel, whose resistance is 438 per cent. greater than that of ordinary steel. Large forgings of nickel steel have shown tensile strengths of 95,000 pounds per square inch, with an elastic limit of 60,000 pounds. The recently-introduced Krupp plates, hardened by a secret process, are superseding the Harveyized plates.

Uses of Iron.

The uses of iron are so innumerable that it would need a considerable part of this work even to name them all. No other metal could replace it, for no other has its many valuable qualities. The tools and weapons of mankind for ages past have been made of iron. In the far past the smith held the highest position among the world's workers. The tools of the farmer, the builder, and other artisans, the sword and shield of the warrior, the armor of the knight, were made of steel or iron. In our days the use of iron has enormously increased. In our factories and workshops are thousands of iron machines, our houses

THE WORLD'S GOLD AND SILVER PRODUCTION, 1899.

COUNTRIES	GOLD		SILVER		
	Ounces (fine)	Value	Ounces (fine)	Coining value	Commercial value
United States	3,437,210	$71,053,400	54,764,500	$70,806,600	$32,858,700
Mexico	411,187	*a* 8,500,000	55,612,000	71,902,500	33,367,300
Canada and Newfoundland	*b* 1,031,563	21,324,300	3,411,644	4,411,000	2,047,000
Africa	3,542,391	73,227,100	. . . . . .	. . . . . .	. . . . . .
Australasia	3,837,181	79,321,600	12,686,658	16,403,000	7,612,000
Russia	1,072,333	22,167,100	134,887	174,400	80,900
Austria-Hungary	94,037	1,943,900	1,895,253	2,450,400	1,137,200
Germany	3,589	74,200	6,242,053	8,070,500	3,745,200
Norway	. . . . . .	. . . . . .	166,908	215,800	100,100
Sweden	3,414	70,600	73,619	95,200	44,200
Italy	8,027	165,900	804,512	1,040,200	482,700
Spain	96	2,000	2,452,940	3,171,500	1,471,800
Portugal	227	4,700	3,790	4,900	2,300
Greece	. . . . . .	. . . . . .	*c* 1,348,411	1,743,400	795,600
Turkey	*d* 687	14,200	*d* 142,157	*d* 183,800	85,300
Servia	*c* 643	13,300	18,322	23,700	11,000
France	. . . . . .	. . . . . .	460,946	596,000	276,600
Great Britian	2,844	58,800	186,582	241,200	111,900
Argentina	6,661	*d* 137,700	383,479	*d* 495,800	230,100
Bolivia	3,311	68,500	10,843,977	14,020,500	6,506,400
Chile	43,229	*c* 893,600	4,754,636	*c* 6,147,400	2,852,800
Colombia	87,535	1,809,500	3,521,563	4,553,100	2,112,900
Ecuador	2,317	47,900	7,734	*d* 10,000	4,600
Brazil	103,983	2,149,500	. . . . . .	. . . . . .	. . . . . .
Venezuela	52,694	*c* 1,089,300	. . . . . .	. . . . . .	. . . . . .
Guiana (British)	98,712	2,040,500	. . . . . .	. . . . . .	. . . . . .
Guiana (Dutch)	28,423	587,600	. . . . . .	. . . . . .	. . . . . .
Guiana (French)	81,691	1,688,700	. . . . . .	. . . . . .	. . . . . .
Peru	30,380	628,000	4,722,687	*c* 6,106,100	2,833,600
Uruguay	*c* 1,664	34,400	. . . . . .	. . . . . .	. . . . . .
Central America	28,263	584,200	924,695	1,195,600	554,800
Japan	38,253	790,800	1,660,200	2,146,500	996,100
China	269,662	5,574,400	. . . . . .	. . . . . .	. . . . . .
Korea	70,570	1,458,700	. . . . . .	. . . . . .	. . . . . .
India (British)	412,032	8,517,500	. . . . . .	. . . . . .	. . . . . .
East Indies (British)	20,562	425,100	. . . . . .	. . . . . .	. . . . . .
East Indies (Dutch)	5,689	117,600	. . . . . .	. . . . . .	. . . . . .
Total	14,831,039	306,584,900	167,224,243	216,209,100	100,321,100

a Estimate, Bureau of the Mint.
b Newfoundland product for 1897 included.
c Figures for 1898 repeated.
d Figures for 1897 repeated.

contain iron stoves, furnaces, and utensils. Iron is replacing wood, brick, and stone in the erection of great buildings; we have iron bridges, iron ships, iron locomotives, and are beginning to make cars of sheet steel. In short, iron is the one thing indispensable to modern civilization.

Iron is not confined to the earth; it extends throughout the universe. The meteorites which fly in all directions through space, and now and then fall upon the earth's surface, are largely made up of pure iron. One of these now in Yale College, which weighs 1635 pounds, contains about 90 per cent. of iron. Another place where iron is found, and where it is of great utility, is in the blood of vertebrate animals. It is iron that gives the red color to our blood. The actual quantity is small. The blood of a man who weighs 140 pounds contains about 38 grains of iron. It is found in the red blood corpuscles, and is supposed to carry oxygen from the lungs through the body. What other service it performs we do not know, but its presence is necessary to health, and in certain conditions of the system iron serves as a valuable medicine.

GOLD AND SILVER PRODUCTION OF THE UNITED STATES, 1899.

STATE OR TERRITORY	GOLD		SILVER		
	Quartz	Placer	Quartz	Lead Ores	Copper Ores
	Fine Ounces	*Fine Ounces*	*Fine Ounces*	*Fine Ounces*	*Fine Ounces*
Alabama	47	183	50	. . . . . .	. . . . . .
Alaska	119,720	151,277	177,383	. . . . . .	. . . . . .
Arizona	117,011	8,667	1,118,251	115,074	631,401
California	570,198	171,682	389,162	109,732	356,975
Colorado	1,238,828	31,765	5,279,741	*a*17,675,657	. . . . . .
Georgia	3,390	2,275	446	. . . . . .	. . . . . .
Idaho	70,842	31,264	1,022,192	3,064,221	. . . . . .
Maryland	57	. . . . . .	2	. . . . . .	. . . . . .
Michigan	4	. . . . . .	. . . . . .	. . . . . .	112,823
Montana	204,300	28,827	4,455,488	2,504,695	9,890,572
Nevada	119,975	910	730,629	179,070	50,818
New Mexico	38,470	2,900	201,585	125,000	200,000
North Carolina	689	1,280	5,529	. . . . . .	. . . . . .
Oregon	57,097	13,887	93,353	50,000	2,000
South Carolina	7,558	197	402	. . . . . .	. . . . . .
South Dakota	313,037	. . . . . .	185,992	. . . . . .	. . . . . .
Tennessee	. . . . . .	8	1	. . . . . .	. . . . . .
Texas	333	. . . . . .	519,972	. . . . . .	. . . . . .
Utah	169,631	. . . . . .	1,542,702	5,028,660	611,745
Virginia	205	169	189	. . . . . .	. . . . . .
Washington	30,894	4,390	138,161	148,500	3,000
Wyoming	. . . . . .	1,277	. . . . . .	. . . . . .	. . . . . .
Total	3,062,286	450,958	15,861,230	29,000,609	11,859,334

a Lead and Copper Ores.

Iron and Gold.

Iron, while the most abundant and useful of the metals, is only one among many, each of which has some valuable quality of its own, while most of them are superior to iron in one particular—that of resistance to oxidation. Iron when wet or moist is very susceptible to the attacks of oxygen, which converts it rapidly into rust, or iron oxide, and destroys its usefulness. This is not the case with the metal with which we are now concerned—gold, the chief of the precious metals. It resists oxygen under all ordinary circumstances, and, therefore, is usually found in its pure or native state, while iron is found only as an oxide or other chemical compound, except in the case of the native iron which falls to the earth from space in meteorites.

Gold, while very rare as compared with iron, is almost as widely diffused. Traces of gold can be found almost everywhere in the clays and sands of the earth, while vast quantities of it exist dissolved in the waters of the ocean. But there are few places where it is plentiful enough to pay for the labor of extracting it. Absurd ideas have been entertained of gaining riches by getting the gold from sea-water, but as there are only a few grains of the precious metal in a large volume of water, the cost would far exceed the result. Therefore, though gold may exist under our feet in every section of the earth, there are not many regions where it pays to seek for it.

APPROXIMATE AMOUNT OF MONEY IN THE WORLD IN 1899.

Countries	Monetary System	Ratio Between Gold and Full Legal Tender Silver	Ratio Between Gold and Limited Tender Silver	Gold Stock	Silver Stock	Uncovered Paper	Per Capita			
							Gold	Silver	Paper	Total
United States	Gold and Silver	1 to 15.98	1 to 14.95	[illegible]	[illegible]	[illegible]	$12.[illegible]	[illegible]	[illegible]	$25.25
United Kingdom	Gold		1 to 14.28	462,300,000	111,900,000	111,600,000	11.50	2.78	2.77	17.05
France	Gold and Silver	1 to 15 1-2	1 to 14.38	810,[illegible]	[illegible]	161,100,[illegible]	21.0[illegible]	10.92	4.18	36.1[illegible]
Germany	Gold		1 to 13.957	672,800,000	208,200,000	156,700,000	12.86	3.98	3.00	19.84
Belgium	Gold and Silver	1 to 15 1-2	1 to 14.38	[illegible]	[illegible]	[illegible]	4.[illegible]	[illegible]	12.[illegible]	[illegible]
Italy	Gold and Silver	1 to 15 1-2	1 to 14.38	98,000,000	43,900,000	174,900,000	3.09	1.38	5.52	9.99
Switzerland	Gold and Silver	1 to 15 1-2	1 to 14.38	[illegible]	10,700,000	17,400,000	7.74	3.45	5.61	16.80
Greece	Gold and Silver	1 to 15 1-2	1 to 14.38	500,000	1,[illegible]	[illegible]	.21	.62	12.12	12.95
Spain	Gold and Silver	1 to 15 1-2	1 to 14.38	53,400,000	37,800,000	187,500,000	2.92	2.06	10.24	15.22
Portugal	Gold		1 to 14.[illegible]	[illegible]	9,[illegible]	[illegible]	1.02	1.88	14.74	17.64
Roumania	Gold and Silver			13,100,000	7,100,000	20,200,000	2.42	1.31	3.75	7.48
Servia	Gold and Silver			1,000,000	1,800,000	3,600,000	.41	.75	1.50	2.66
Austria-Hungary	Gold		[illegible]	221,[illegible]	147,[illegible]	[illegible]	[illegible]	3.21	2.24	10.27
Netherlands	Gold and Silver	1 to 15 5-8	1 to 15	30,200,000	56,400,000	47,200,000	6.01	11.28	9.44	26.76
Norway	Gold		1 to 14.88	[illegible]	2,[illegible]	[illegible]	4.1[illegible]	1.[illegible]	2.4[illegible]	7.62
Sweden	Gold		1 to 14.88	[illegible]	[illegible]	[illegible]	2.[illegible]	1.[illegible]	[illegible]	9.50
Denmark	Gold		1 to 14.88	16,900,000	5,400,000	5,900,000	7.35	2.35	2.56	12.26
Russia	Gold		1 to 23.24	740,400,000	81,900,000		5.69	.63		6.32
Turkey	Gold and Silver	1 to 15 7-8	1 to 15 7-8	50,000,000	40,000,000		2.07	1.66		3.73
Australasia	Gold		1 to 14.28	132,100,000	7,000,000	22,500,000	25.90	1.37	4.41	31.68
Egypt	Gold		1 to 15.68	30,000,000	6,400,000		3.06	.65		3.71
Mexico	Silver	1 to 16 1-2		8,600,000	106,000,000	4,000,000	.66	8.15	.31	9.12
Central Am. States	Silver			1,000,000	11,400,000	18,100,000	.30	3.35	5.32	8.97
South Am. States	Silver†	1 to 15 1-2		72,700,000	29,000,000	1,159,300,000	1.91	.76	30.51	33.18
Japan	Gold		1 to 32.[illegible]	[illegible]	25,[illegible]		1.2[illegible]	[illegible]		1.75
India	Silver	1 to 15			568,400,000	47,400,000		1.91	.16	2.07
China	Silver				750,000,000			1.96		1.96
Straits Settlements	Silver				212,000,000			53.82		53.82
Canada	Gold		1 to 14.28	20,000,000	5,000,000	40,500,000	3.70	.93	7.50	12.13
Cuba	Gold and Silver	1 to 15 1-2		2,000,000	1,500,000		1.11	.83		1.94
Hayti	Gold and Silver	1 to 15 1-2		1,200,000	[illegible]	3,700,000	1.20	[illegible]	3.70	8.40
Bulgaria	Gold and Silver	1 to 15 1-2	1 to 14.39	1,000,000	6,800,000		.30	2.06		2.36
Siam	Silver			20,000,000	193,400,000		4.00	38.68		42.68
Hawaii	Gold and Silver	1 to 15.98	1 to 14.95	4,000,000	1,000,000		40.00	10.00		50.00
Cape Colony	Gold		1 to 14.28	37,500,000	1,000,000		17.86	.47		18.33
South African Rep.	Gold		1 to 14.28	29,200,000	1,200,000		26.51	1.09		27.63
Finland	Gold		1 to 15 1-2	4,100,000	500,000	10,800,000	1.58	.19	4.15	5.92
Total				4,621,700,000	3,836,100,000	2,836,300,000	3.51	2.91	2.15	8.57

*July 1, 1899. †Except Venezuela, Chile and Peru.

Gold, Its Character and Sources.

Gold is a metal of a beautiful yellow color, quite soft, and extremely ductile and malleable. It is very heavy, its specific gravity being over 19¼, while that of iron is 7.8439, much less than half the weight of gold. It melts at 2192° F., and begins to volatilize at a little higher temperature. It does not tarnish in the air, even when melted, and no acid attacks it, but it may be dissolved by a mixture of nitric and hydrochloric acids, the chlorine set free from the latter being the active agent.

There are two sources of the gold of commerce, one being the quartz of mountain rocks, in which it occurs in veins, the gold being found in strings, plates, scales, and small masses. But while the native home of gold is the quartz rock, it is most commonly gathered from the gravel or sands of alluvial deposits, in which it occurs in the form of flattened scales and grains, the latter varying in size, and sometimes composing what are known as nuggets. While these are not usually of much size, some very large ones have been found. In 1861 a nugget weighing 201 ounces was found in California, while the Russian diggings have yielded a nugget weighing 96 pounds Troy. Still larger are the Blanch Barkley nugget from Australia, weighing 140 pounds, and the Welcome Nugget, found at Ballarat, which weighed 184 pounds 8 ounces, and yielded $41,882.62 worth of gold.

The Placer Gold Fields.

The great placer gold fields outside the United States, are in Australia and Siberia. Within the United States California has long been the principal gold-yielding State, the other important States being Colorado, Montana, Idaho, Nevada, and South Dakota. In the East small quantities of gold have been found in the Carolinas and Georgia. Our new Territory of Alaska has recently developed as a country ric' in gold, and may eventually prove one of the leading gold fields of the earth. The Philippines may also become a valuable source of gold. In California the placer deposits have been worked so diligently as to be in some measure exhausted, and the mining fraternity are now attacking the mother veins, with costly apparatus and the use of large capital. Arizona also gives promise of being rich in gold, and the miners are now congregating on its arid soil. In South Africa, the gold occurs in rock ledges, and needs to be obtained by mining processes.

As regards the origin of the placer or alluvial deposits, it may be said that they are the result of the denudation of the hills and the carrying down of this mineral matter by rain rivulets to the streams. The gold remains undissolved in the water and its great weight causes it to sink and collect on the bottom of the streams. As a result many of the richest placer deposits are the dry beds of old rivers. At Cape Nome, Alaska, the gold-bearing sands have been carried to the sea, and afterward thrown up by the waves on the beach.

Production of Gold.

The United States and Australia have long held the leading place in gold production, but of late years the yield of the gold reefs of the Transvaal, South Africa, has largely increased, and in 1898, the year preceding the recent war, the Transvaal gold stood at the head. A previous table shows the world's gold and silver harvest.

In North America the region ol Alaska and the adjoining district of Canada have of late years come into the field as important gold producers, the yield of the Klondike and Cape Nome fields in the year 1900 being about $17,000,000, with large future possibilities.

The total production of the precious metals since the discovery of America in 1492 is estimated in money value at $9,508,317,200 for gold, and $10,972,431,400 for silver. Of these great sums three-fourths the gold and more than half the silver were the product of the nineteenth century. There is no falling off in the harvest of these metals, the yield being steadily growing greater. As regards their use, though they are very largely employed as coined money, large quantities of them are consumed in the arts. In the year ending July 1, 1900, the world consumed in this direction $72,658,500 worth of gold and $52,990,500 of silver, while the coinage of the nations amounted to $466,110,614 in gold and $166,226,964 in silver. The total value of the precious metals in the world at that date was, gold, $4,841,000,000; silver, $3,818,900,000.

Placer Mining.

The methods of mining in placer deposits of gold was long very simple. The "golden fleece" of the Greek legend is supposed to have been a sheepskin pegged down in the current of the Phasis River to entangle in its wool the grains of gold borne down by the water. Sheepskins are still used for this purpose in Hungary, Savoy, and Ladakh, and ox-hides in Brazil. In California a simple pan was first used to wash the gold from the sand and clay. Gold being about seven times as heavy as the other materials of the river bed, it sank to the bottom, while those were washed away. Then the cradle, or rocking trough, came into use; afterwards the flume, a sort of wooden ditch, of great length, with catch basins to arrest the gold as the water carried away the debris. In "hydraulic mining" the raised beds of old rivers were washed away by water conveyed in tubes and hurled against them with great force. In one district in Victoria over 33,500 tons of wash-dirt were treated in three months for an average yield of 18½ grains of gold per ton—about one part in 700,000.

Vein Mining.

Vein mining for gold is now the chief method employed in the United States, and is the only one in use in South Africa. In this the vein-stuff, after being mined from the rocks, is crushed to powder under the hammers of stamp mills or in powerful rolling mills. It is then treated like placer dirt, being washed in troughs with catch-pockets, in which mercury is used to amalgamate with and hold the fine particles of gold.

This is the old method, but new methods are now in use which save far more of the gold and allow ores which were formerly abandoned to be worked with profit. The *Chlorine process* employs an electric current as an aid to rapid amalgamation. The crushed ore is mixed with salt water in a caldron in which a revolving apparatus keeps the liquid in constant motion. From the revolving arms an electric current passes to a dish of mercury in the bottom. The current decomposes the salt, or chloride of sodium, its sodium going to the mercury, while its chlorine rises and dissolves the fine floating gold. A secondary action follows, the electric current now decomposing the chloride of gold. The gold goes to the mercury and is amalgamated; the chlorine rises and dissolves more gold, and thus the process is continuously repeated. Chlorine is not the only substance used, cyanogen being also employed. In one *cyanide process* a mixture of potassium cyanide and cyanogen bromide is used with remarkable results. By these methods low-grade ores, which formerly it did not pay to work, can now be profitably reduced. This is the case with the South African ores, which are too low in gold to be worked with profit by the old methods.

Silver Mining.

What has been said of the yellow metal, gold, applies in a measure to the white metal, silver, except that the latter is worked only from the rock, since it does not occur in placer deposits. Silver is frequently found in the native state, though it is generally alloyed with gold, arsenic, and antimony. The native alloy in the great Comstock lode of Nevada contains about 43 per cent. of silver. The galena ores of the United States, except those of the Mississippi Valley, nearly all contain native silver in quantities varying from 0.10 to 3.00 per cent. In these the mixture is heated till the lead melts and floats away, carrying with it the silver, while a spongy mass of copper remains. The rich alloys are reduced by the process of amalgamation. Great single masses of native silver have been found. At Freiberg, in Saxony, a mass weighing 140 pounds was discovered; while in the Copenhagen Museum is a lump weighing 560 pounds. Another piece nearly three times as heavy has been found.

There are numerous ores of silver, of which the most important are Argentite, or Sulphide of Silver; Sulphanite and Pyragyrate, or Sulph-antimonites of Silver; Proustile, or Sulph-arsenite of Silver; Chloragyrite, or Chloride of Silver and Embolite, or Chloro-bromide of Silver. The great silver-producing region of the United States was discovered as late as 1859. The lodes occur in the Rocky and Sierra Nevada Mountains, in the States of Nevada, Montana, Idaho, California, Colorado, and Utah, and the Territories of Arizona and New Mexico. Outside the United States silver occurs abundantly in Mexico and in parts of the Andes of South America, and in various sections of the Eastern Hemisphere. The production of silver has enormously increased since the discovery of the rich deposits in Western North America. Mexico rapidly rose to the head as the greatest silver-producing country of the world, and it retains this position, though it is closely approached by the United States. Nevada, formerly the great silver region of this country, has now decidedly fallen off, and Colorado and Montana have risen to the head of the silver States. The subjoined table shows the production of gold and silver in the several sections of the United States for the year ending January 1, 1900.

In conclusion of our treatment of the precious metals, we give, in the foregoing table, the approximate amount of money in the world, as compiled from the report of the Director of the Mint for January 1, 1900.

Copper Production.

Though copper occurs in many parts of the earth, the whole world looks to the United States for its main supply of this important metal. This country contains three enormous deposits of copper in the Lake Superior region, at Butte, Montana, and in Arizona, while smaller quantities are found in New Mexico, Colorado, Vermont, and some other States. In the rich mines of Lake Superior native copper is found, and large masses have been obtained. These mines were worked by the Mound Builders long before white men came to America, copper being the only metal they possessed. It is now found in this region in the form of nodules or sheets, distributed through the veins. In Montana, the copper occurs in granite, usually in connection with silver. In Arizona, it is found in the form of oxides and carbonates. The world's production of this metal in 1898 was 434,239 tons, of which 239,241, or more than half, were mined in the United States. Spain and Portugal came next, with 53,225 tons. In the United States, the yield of Montana was 96,861, of Michigan 69,942, and of Arizona 53,940 tons.

Copper is a metal used for many important purposes in the arts, large quantities of it being employed in sheathing ships and in the manufacture of boilers and utensils for domestic purposes. A highly valuable property is the fact that it is one of the best conductors of electricity, silver being its only close rival in this field. As a result, copper has come widely into use as a material for trolley-car wires, and in all other cases where large quantities of electricity need to be conveyed. Alloyed with zinc, it forms the very useful substance, brass, while with different proportions of tin it forms bronze, bell-metal, gun-metal, and speculum-metal.

Lead Production.

Lead, the softest of the metals in common use, and one of the most easily melted, owes much of its usefulness to these qualities. It can be readily rolled into thin sheets and drawn into tubes or pipes. For one of its extensive uses, the covering of roofs, its weight and fusibility are against it, since it melts easily, and the fall of the molten lead, in the case of a fire, is apt to spread the conflagration. The chief ore of this metal is galena, or sulphide of lead. This is found in extensive veins in parts of England and Spain, while sulphide of lead is abundant in Australia. Galena exists in large deposits in Illinois, Missouri, Iowa, and Wisconsin, and in smaller quantities in many other States. In Colorado, Utah, Idaho, and Montana lead abounds in the silver-mining districts, and the production of silver yields it in such large quantities as a by-product, that in this metal, as well as in copper, the United States is the largest producer in the world. The annual production of this country is about 200,000 tons.

Tin, Its Production and Uses.

The white metal tin is, like lead, easily melted and is extremely malleable at a temperature of 212°. It has a great tendency to crystallize, and when bent yields a peculiar cracking sound called "the cry of tin," which is due to the friction of the internal crystals. The principal tin-yielding regions have long been Cornwall, England, and Banca, in the Dutch East Indies. Of recent discovery are large deposits in the Malay Peninsula and in parts of Australia. In past times the British Islands were known as the Tin Islands, from their wealth in this useful metal. Tin sometimes occurs in the native state, but commonly as an oxide, which is known as tin stone, wood tin, stream tin, or kasseterite. From this ore tin is obtained by stamping and roasting in a furnace at a moderate temperature. Deposits of tin have been found in the United States at South Riverside, California, in the Black Hills of South Dakota, and in localities of Virginia and North Carolina, but in none of these has mining proved profitable. The world's production of tin in 1898 was 73,268 tons, of which 45,901 tons came from the Malay Peninsula, 14,380 from the Banca district, 4,200 from Cornwall, 4,464 from Bolivia, and 3,220 from Australia.

The uses of tin are so well known that we need only glance at them. Its resistance to oxidation renders it very useful as a coating for iron, and this combination, known as tin-plate, is employed for a large number of purposes. It is abundantly used for the canning of fruits and other food stuffs. Formerly Wales was the centre of the tin-plate industry, but under the McKinley tariff of 1891, its manufacture was begun in the United States, and it has now grown into an important industry. In 1897, there were about 7,000,000 boxes of plate produced, holding 112 plates to the box, a supply sufficient to meet the home demand. About one-quarter of this demand comes from the Standard Oil Company and the Armour Packing Company, while the remainder is mainly used in roofing and in tin boxes and cans for various purposes.

Tin forms a large number of alloys with other metals, yielding Britannia metal, pewter, solder, bell metal, bronze, gun-metal, speculum-metal, etc. Tinfoil is an alloy of lead and tin, beaten to great thinness, for use in wrapping up and excluding the air from small articles. The thinnest foil is one two-thousandth of an inch in thickness. If articles of food are to be wrapped, only pure tin is admissible, lead in contact with food being dangerous. Tinfoil is often embossed, lacquered with gold, printed in colors, and otherwise ornamented, being often made very beautiful.

Zinc.

The bluish-white metal, zinc, is quite malleable and ductile at temperatures of 200° to 300°, and melts at 773°. Its ores are found abundantly in many parts of the earth, and in ancient times the alloy of zinc and copper was in use in the form of brass, though zinc, as a separate metal, was not known in Europe until after 1700. It seems to have been known much earlier in China. Its total production in 1898 was 467,749 tons, of which Germany yielded 191,836 and Upper Silesia, 99,232 tons, while smaller quantities came from Austria, the Netherlands, France, Spain, Russia, and England, and 103,514 tons from the United States. In the form of red ore it occurs in New Jersey, and as Calamine, or carbonate of zinc, near Lancaster, Pennsylvania.

Zinc has long been used as one of the constituents of brass, and has of late come largely into use as a coating for iron, in what is known as galvanized iron. It forms, alloyed with copper, a part of the material of all our pins. Other uses are as a protective covering of floors under stoves, and as a lining for bath-tubs. The oxide is largely used to adulterate or replace white lead in paints.

Nickel.

This metal was not known till 1751, when it was discovered by Cronstedt, who called it kupfer-nickel, or old Nick's Copper. It is a brilliant white, ductile metal, nearly as infusible as iron, with which it shares the property of magnetic attraction. It is associated with iron in meteorites, being one of the metals which come to us from space. Its great resistance to oxidation renders it very useful for the plating of steel instruments, and for coating chemical vessels and cooking pots of iron. Nickel-plating has become one of the necessary arts of modern times. A new and important use for nickel is an alloy for steel in the plating of war-vessels, a small percentage of this metal greatly increasing the hardness of the armor. It forms useful alloys with copper and zinc, of which German silver and some white compounds used in coining are the most important. Our nickel half-dime is a daily handled example.

Mercury or Quicksilver.

The ancients were acquainted with only seven metals, and of these the glittering liquid mercury formed one. With the exception of bromine, it is the only element that exists in a liquid state at ordinary temperatures. It occurs in nature in the form of cinnabar, or sulphide of mercury, which for ages past has been worked at the famous mines of Almaden, in Spain. Other mines are at Idria, in Transylvania, and New Almaden, in California, and it is also found abundantly in China, Japan and Peru. In obtaining mercury from cinnabar the sulphur is burned out and the metal obtained by distillation. In another method the ore is mixed with iron-filings or lime, the sulphur combining with the iron or calcium and leaving the metal free.

The uses of mercury are numerous and important. With many metals it forms a pasty mass called amalgam, a property which is taken advantage of in the mining of gold and silver, as already described, also in gilding and the making of mirrors. Its great increase in volume between the freezing and boiling points of water renders it very useful in the thermometer, and its weight makes it of value in the barometer. Its ore is of use in the red paint called cinnabar, and its compound with chlorine yields us the useful medicine calomel.

Aluminium.

It is a singular circumstance that one of the most abundant, and what promises to be one of the most useful, of the metals was not known to exist a century ago. Buried in enormous quantities in the clay of the earth, it lay hidden for uncounted generations, waiting for the chemist of the nineteenth century to trace it to its iair and bring it forth for man's use. Combined with oxygen it gives us alumina, of which we have splendid examples in the precious gems sapphire and ruby, and useful ones in the very hard substances corundum and emery. Alumina combined with silica forms the basis of all varieties of clay, and is thus found almost everywhere in the upper strata of the earth's surface.

In 1827 the chemist Wœhler first obtained this well-hidden metal, and again, more perfectly, in 1845, but it was not until 1854 that Deville obtained it nearly pure and discovered its properties. He employed potassium, and afterwards sodium, as the reducing agent, and its production was so cheapened that works to manufacture it were started in France, England and the United States. It was still a costly product, its price being $30 a pound in 1857, $17 in 1860, and $12 as late as 1885. In the year 1884 a cap of aluminium made in Philadelphia, was placed upon the lofty Washington Monument.

In 1886 a new process of reduction of the ore was employed, and since then this metal has been produced in the electric furnace, a powerful current being sent through carbon poles, with the result of rapidly separating the metal from the clay. In one of these furnaces 400 pounds of Aluminium a day may be produced. In a few years the price fell to less than 60 cents a pound, and in 1895 the yield in America was 900,000 pounds and in Europe much greater. In 1897 it had increased in the United States to 4,000,000 pounds, in 1898 to 5,200,000 pounds, and is steadily increasing in quantity and falling in price. This is largely due to the use of the great electrical power plant at Niagara in its production.

Aluminium is a white metal, remarkable for its low specific gravity, which is 2.5 to 2.67, its weight being but one-third that of iron and less than one-seventh that of gold. This, and its resistance to oxidation, render it very useful in situations where the heavier metals could not be used. The most striking illustration of this is its employment as an external coating for the immense tower of the Philadelphia City Hall. It is used for many other purposes where lightness is desirable, as in the manufacture of bicycles and racing boats. A recent effort was made to reach the North Pole in aluminium boats. Of the alloys of this metal, those made with copper are very hard, and take a high polish. One of these, in which there is about 10 per cent. of aluminium, is of a beautiful golden-yellow color, and is manufactured under the name of aluminium bronze. It is used for table cutlery, in place of silver-plated ware, for watch chains, carriage mountings, metallic fittings, screw propellers, etc. Aluminium also forms a white alloy with copper, zinc, silicon, and manganese, which is known as silver bronze, and is used to replace German silver. It is very strong and has great electrical resistance, and is drawn into tough wire for resistance coils. An alloy with chromium is as hard as steel, and one with 70 per cent. of iron is hard enough to scratch glass.

Alum, the important chemical substance from which this metal gets its name, is a sulphate of aluminium and potassium.

Other Metals.

There are numerous other metals known to chemistry, but none of such practical importance as those named. All of these have been discovered within the nineteenth century and many of them are very costly in their pure state, some of them being far more high priced than gold. Sodium is best known in the forms of its carbonate—the common soda which is used for so many purposes; and its chloride, or common salt, which exists in immense quantities dissolved in the waters of the ocean, or deposited as rock salt in the crust of the earth. The metal Potassium is the basis of another important alkali, that known as Potash, a highly useful chemical product. Magnesium is the basis of the substance magnesia, best known as a medicine. Calcium is a metal existing in the common and very useful substance lime, which is known in chemistry as oxide of calcium. This metal burns freely and brilliantly, and the same may be said of magnesium, each yielding a flashing light, of use in photography. A recent product of Calcium is the carbon compound known as Calcium Carbide, made in the electric furnace, and the source of the brilliantly illuminant acetylene gas. Platinum, one of the rare metals, finds its chief use in its high melting point and great resistance to heat. Costly as it is, it is indispensable for crucibles which are to be exposed to intense heat. It is also of important use in the incandescent electric light, in which platinum wire is sealed into the glass bulb and conveys the current. It is the only substance that can be used without breaking the bulb.

Petroleum or Rock Oil.

We must now speak of what may be called liquid mining,—the obtaining of a mineral substance in a liquid state whose abiding place is often deep within the crust of the earth. This substance, known as Petroleum, or Rock Oil, is no new discovery. For ages past it has been making its way to the surface in certain localities, and has long been used for lighting purposes at Baku, on the Caspian Sea, and for other purposes by the Indians on the Alleghany River. It is also now found at Rangoon, in Burmah, at places in Austria, Sumatra, Java, Trinidad, Japan, Peru, and Canada, and in Ohio, Virginia, California, and other American States.

The mining for petroleum began in 1859, when Colonel Drake bored the first wells at Titusville, on Oil Creek, Pennsylvania, and obtained a yield of 1000 gallons of oil a day. This gave rise to the "oil fever," in which thousands of wells were sunk, and vast quantities of oil obtained. Of the other localities in which rock oil is found, the most important is Baku, in Russia, on the western shore of the Caspian Sea, which yields immense quantities of a heavy oil. The percentage of burning oil in this is small, but its cheapness renders its distillation profitable. In 1870 the Standard Oil Company was formed by Rockefeller, Andrews, and Flagler, of Cleveland, Ohio. This has now become the Standard Oil Trust, and controls the whole vast product of the American oil fields. The oil, instead of being carried by railroad, is sent through pipes, hundreds of miles in length, to the sea-coast and other refining centres, where the crude material is prepared for use. Though the exhaustion of the oil wells has often been predicted, the production of the United States doubled between 1890 and 1900. The total world's product is now over 5,000,000,000 gallons yearly, of which 2,500,000,000 are produced in the United States, 2,250,000,000 in Russia, and the remainder principally in Austria, Sumatra, Java, and Canada.

Uses of Petroleum.

The most important use of petroleum is as an illuminant. For this purpose it is refined by distillation. A light oil, composed of gasoline and naphtha, first rises, and is condensed, the naphtha being afterwards converted into benzine. The remaining substance is again distilled, yielding, when refined, the valuable colorless illuminating oil. When this has been taken off fresh steam is forced into the retort, and a heavy oil, of value for lubricating purposes, comes over, leaving behind a black, tarry product. This heavy oil, when cooled down to 30° F., often yields paraffine in large quantities, which is separated by pressing and straining. The remaining substance may be used for pavements, or, mixed with grease, to lubricate heavy machinery. Petroleum contains, on an average, 20 per cent. of light oil, 50 per cent. of burning oil, 22 per cent. of lubricating oil, and 8 per cent. of carbonaceous and tarry residue.

Natural Gas.

Various theories as to the origin of petroleum have been offered, none of which are fully accepted. One important characteristic of it is the existence of a large quantity of gas, which arises with the oil, or in many cases comes off alone, and which is, no doubt, closely connected in origin with petroleum. This gas was not used until after 1880, and its presence was an annoyance, for it occasionally caught fire and burned with a volcanic flame. It was afterwards carried by pipes to Pittsburg and other places, and became the favorite fuel for manufacturing and domestic purposes. At one time Pittsburg consumed 500,000,000 cubic feet daily in 28,000 houses and 900 manufactories, while great quantities were found in wells at several points in Ohio and Indiana and piped to neighboring cities. But the supply is rapidly diminishing, and coal, for a time largely banished, is again resuming its sway.

Asphaltum and Its Uses.

Petroleum is generally supposed to have originated in organic matter, and the same origin must be ascribed to Asphalt or Asphaltum, a variety of bitumen supposed to arise from the decomposition of vegetable substance. It is found in most parts of the world, is frequently found floating on the surface of springs, and is abundant in the Dead Sea. It occurs very widely in the United States, and there are enormous deposits in Mexico, supposed to have originated in petroleum. Lakes of it exist at San Timolis, in Venezuela, and on the island of Trinidad, each of them being about three miles in circumference. The Trinidad lake is 18 feet deep near the sides and 78 feet in the centre, and is estimated to contain 6,000,000 tons. Large quantities of commercial asphalt are obtained from this lake, and others from Cuba, Dalmatia, Syria, and elsewhere.

Asphaltum occurs as a dry solid, with a glossy black surface and conchoidal fracture. It melts easily, and burns readily, with little residue. It is used in the making of varnish, in water-proofing, and for insulating purposes. Asphaltic cement is of great value in resisting the entrance of water, and is employed in tunnel construction. Large quantities of asphalt are used for roofing purposes, the roofing materials being saturated with a mixture of this substance, coal-tar, pitch, and petroleum. But its most important recent use is for paving. In most of the large cities of civilized lands many miles of asphalt street pavements now exist. In 1890 there were more than 200 miles of such pavements in United States cities, and since then a much greater length has been laid. The city of Washington is very largely paved with this admirable material for light driving use.

How Clay is Utilized.

We have not yet exhausted the important materials which the crust of the earth offers to the use of man. As valuable in their way as any of the metals named are the immense deposits of clay which form the external covering of the rocks in most regions of the earth, and are specially abundant in the river valleys. For building material clay stands first in the history of civilization. During the immense period of 4000 or 5000 years bricks of clay, dried in the sun, formed almost the only building material used in the very ancient kingdoms of Babylonia and Assyria, and similar material, known as adobe, is still in use in Mexico and elsewhere. In later ages burnt bricks came very generally into use, and these are now far the most important of all the building materials used by man, while large quantities of them are consumed in paving, in the building of arches, tunnels, etc., and pipes of burnt clay are indispensable for drainage. In the form of terra-cotta burnt clay is largely used for ornamental architecture, vases, statues, and other purposes. The total value of bricks and other clay products in the United States in 1898 was $58,470,543.

These are far from being the only uses which man makes of this abundant material. At a very remote date he began to mould clay into the form of domestic vessels, kneading it with water, hardening it with fire, and ornamenting it with simple devices. The making of burnt clay-ware is one of the oldest of the arts, and specimens of broken pottery are found abundantly among the relics of early man. As time went on, the product of the potter grew more elegant in shape and more artistic in decoration, until in ancient Greece it became one of the chief products of the fine arts. The making of pottery has never been suffered to die out. In modern times it is among the most important of the arts. Every family depends largely for domestic comfort on some form of baked clay, now as the rough, strong stoneware used in pots, jugs, and varied cooking utensils, now as the finer and more delicate ware used in the cups and plates of our tables and other articles of utility.

Manufacture of Porcelain.

From domestic we pass to fine art in the use of porcelain, the richest and most delicate kind of pottery, which is made with the utmost care and skill from the finest and purest clays. This costly and elegant material varies from the semi-transparent and richly ornate table-ware to the highly artistic ornaments of drawing-rooms and museums, in the forms of vases, statuettes, and other products of art, some of which call for the highest skill and rarest genius of the artist. From the rude vessel shaped by primitive man to the nobly artistic vases of many modern art collections there is a vast evolution, yet burnt clay stands at the bottom of it all.

The manufacture of porcelain and other fine wares has become a very important industry of the United States, its chief centres being at Trenton, New Jersey, and East Liverpool, Ohio. The United States possesses inexhaustible beds of the richest kaolin, or porcelain clay, and endless deposits of the commoner pipe, potters' and fire clay, with reservoirs of moist colored clays, and the other materials used in the potter's art. Yet in addition to the vast quantities of pottery made in this country, there is an annual importation of china and earthenware valued in 1899 at $7,600,000.

Not only the clays, but the stones of the earth's crust are employed in useful purposes by man, and from a very early date stone has been used for the most pretentious architecture and the most stupendous erections. From the mighty pyramids and enormous temples of Egypt, and the huge megalithic structures of other ancient lands we come down to the artistic temples of Greece, the charming examples of Saracenic architecture, the ornate Gothic cathedrals of the Middle Ages, and the varied examples of religious and public architecture of our own times. Aside from these grander structures are multitudes of dwellings in which stone replaces brick.

Common Building Stones.

Far the most common of building stones are the sandstones and limestones, while granite is used to a considerable extent. Sandstone of fine brown and reddish shades of color is exceedingly abundant, and is very widely employed for the more pretentious mansions, while limestone, both in its finest form of marble, and in its non-crystalline but strong and hard varieties, is a favorite material for churches, banks, and other public buildings. For interior decoration the many richly-colored marbles are of unsurpassed beauty. The use of granites is also considerable, and there are various other building stones more rarely employed.

The United States abounds in excellent building stones. Sandstones are widely distributed, have much variety of tint and texture, and are comparatively cheap, so that, aside from brick, they form the most valuable group of American building materials. Building granites are chiefly obtained from the quarries of Maine. They vary in color, the Calais stone being red, the Spruce Head variety gray, and that from Hallowell nearly as white as marble. All the other New England States, and some other States of the Union, contain granite suitable for building purposes, and of late years polished granite has come largely into use for house columns and cemetery ornament.

Marbles of fine character are also abundant, the strong and durable white marble from Lee, Massachusetts, being that used in the Capitol at Washington and the Philadelphia City Hall, the largest public edifices in America. Rutland County, Vermont, is the centre of the marble industry for purely decorative purposes, though of late years colored marbles of great beauty have been found in many parts of the United States. Fine statuary marble has also been found in this country, though for ages past Italy has been the chief source of supply to sculptors. The famous old quarries of Carrara are still rich in the finest marbles, of which they supply from 40,000 to 50,000 tons per annum. The total production of building stone in the United States is estimated at a value of $30,000,000 yearly.

Mineral Production.

The total value of all the minerals produced in the United States in the calendar year 1899 was $876,008,946, a product 40 per cent. greater than that of 1889, the figure for which was $697,820,790. The greatest increase in 1899 was in the value of the pig-iron product, which increased to $245,172,654, or about 110 per cent. over 1898. The enormous increase was due to the phenomenal demand and high prices. The increase in coal production added over $48,000,000, or 23 per cent. to the 1898 value. Copper increased nearly 60,000,000 pounds in quantity and over $42,000,000 in value, the ruling prices being higher than for several preceding years.

Crude petroleum advanced nearly $20,500,000, or about 45 per cent., due principally to advanced prices, the production increasing less than 4 per cent. The value of the natural gas consumed in 1899 was placed at a little over $20,000,000, against 15,300,000 in 1898, due entirely to the higher prices charged.

An increase of about 10 per cent., or from $64,463,000 in 1898 to $71,055,400 in 1899 was shown in gold production. The production of silver showed a small increase. Lead production decreased 6 per cent., but increased over $2,000,000 in value. Zinc increased to 119,408 short tons, valued at $13,731,920. The building stone industry increased nearly $8,000,000. Every year from 1881 to 1898, inclusive, the value of the non-metallic products exceeded the metallic, but in 1899 the metallic was greater by $79,500,000. A change of nearly $90,000,000 occurred in the relative values between 1898 and 1899.

The Deepest Mines.

In connection with the subjects treated in this chapter the following facts may be of interest.

The most extensive mines in the world are those of Freyburg, Saxony. They were begun in the twelfth century, and in 1835 the galleries, taken collectively, had reached the unprecedented length of 123 miles. A new gallery, begun in 1838, had reached a length of eight miles at the time of the census of 1878.

The deepest perpendicular mining shaft in the world is located at Prizilram, Bohemia. It is a lead-mine which was begun in 1832. In January, 1880, it was 3,280 feet deep.

The deepest coal mine in the world is near Touney, Belgium; it is 3,542 feet in depth, but, unlike the lead-mine mentioned above, it is not perpendicular.

The deepest rock salt bore in the world is near Berlin, Prussia, its depth being 4,185 feet.

The deepest hole ever bored into the earth is the artesian-well at Pottsdam, which is 5,500 feet deep.

The deepest coal mines in England are the Dunkirk collieries of Lancashire, which are 2,824 feet in depth.

SCIENCE IN ELECTRICITY

We are in the midst of the Age of Electricity. A hundred years ago electricity was a toy; people amused themselves with drawing sparks and giving shocks. To-day, it is the leading power of the world. It is around us on every side. We travel by its aid; it carries our news at lightning speed; it talks for us across the continent; it lights our cities and warms our houses; it does twenty services besides, and as yet it is only in its infancy, no one can say what wonders it reserves for us. This being the case, every one should know something of this wonderful force and its performances. They should know what electricity is and what it does, so far as any one can tell them. Of what it is we know very little. Of what it does we know more. It is proposed in the present chapter to tell the story of this magical force, and state what have been its developments within the recent century.

The Nature of Electricity.

What is electricity? This is a question much more easily asked than answered, unless we adopt the brief and decisive answer of the agnostic, "Nobody knows." For a long time it was supposed to be a substance. Some thought it to be two substances, one attracting the other. At a later date scientists began to look upon it as a motion, an extraordinary rapid agitation of the fine particles of matter. The force of electricity was regarded as the energy developed by this motion. Since we have learned that electricity can travel along the telegraph wire at the speed of many thousands of miles in a second, and reach San Francisco from New York while we are drawing a breath, we feel sure that it is a motion, for no one dreams of matter travelling at so vast a speed.

If it be asked, What kind of a motion is it? the answer is that it is thought to be a wave motion, closely similar to that of light. This is the theory of Mr. Clerk-Maxwell, a Scottish scientist, who found that electricity travels as fast as light. Since then it has been learned that electricity can be reflected and refracted like light, and investigators now feel sure that these two forces are very close relations—either sisters or first cousins. There is one marked difference; light journeys freely in straight lines, through open space; electricity is confined to the surface of matter, from which it cannot escape, and it can be made to follow very crooked lines, along curved and twisted wires.

Electricity is a Force.

Scientists are now satisfied about some other things. At one time it was thought that matter extended in a very rare form through all space, and that light was a vibration of this diffused matter. It is now believed that space is filled with an extremely delicate substance, very much finer than ordinary matter, which has been given the name of ether, and that light is a motion of this wonderfully fine material. If electricity is like light, it also must travel through ether, and we are now taught that the electric current does not really pass along the surface of the telegraph wire or other conductors, but through the ether which surrounds and touches this surface. It is held that matter is too coarse for wave motion to pass through it with any great speed, and that the vast rapidity of the light and electric waves needs some far finer vehicle. All this goes to indicate that science has learned a little about the general character of electricity, even though it does not know its special nature and conditions. What we are principally concerned here with is the fact that electricity is a force. It is set in action by some power, mechanical or chemical, and when it has completed its journey, long or short, it displays a power similar to that which set it going, though not equal, for some of it is lost in the journey.

Magnetic Attraction.

Now let us turn our attention to Magnetism, another of the wonderful powers of nature. It is very different in character from electricity, which it resembles only in one thing, that both possess the power of attraction and repulsion. Yet like many unlike people these two are good friends, and work together in harmony. In fact, if it were not for magnetism, all the wonderful power of electricity would be of little use to us. Without the magnet we could get no rapid news by telegraph, and the trolley car would stand still upon its track; so that the modern world is as greatly indebted to the magnet as it is to the electric current.

We have said something about the nature of electricity; now let us say something about the nature of magnetism. Very likely all of you have read the story of how Sir Isaac Newton saw an apple fáll from a tree and began to think about what made things fall downwards instead of upwards or sideways. He came to the conclusion that there is some principle in matter that makes it draw all other matter towards it, a power which is known as attraction. All things in the air are drawn downward to the earth because the earth is a great mass of matter, and has a very powerful attraction. But the earth itself tends to fall towards the much larger sun, and all the suns of space are pulling steadily upon one another. It is only their rapid motion in other directions that keeps them from all tumbling together and forming one monstrous central sun, as large almost as a universe. This wonderful force is called gravitation, or universal attraction.

But wait a moment. Let us see if this is the whole story. Take in your hand a piece of iron that has been treated in a certain way and hold it over some iron nails or other small bits of iron. You will quickly see that all things do not fall downwards, for the nails will at once fall upwards and cling to the end of the piece of iron. Here is a wonderful mystery; this iron bar or horseshoe has in it an attraction for small things greater than the attraction of the earth. We call this piece of iron a magnet, but that is only giving it a name. What magnetism is we do not know.

This much we do know, that the magnetic force does not belong to the iron. We can give magnetism to a piece of iron, and can take it away again. By rubbing it in a certain way with a magnet we can make it attract other iron. By rubbing it in the opposite direction we can deprive it of this power. We judge from this that magnetism also is a motion, not a substance. But it is not a traveling motion, like light and electricity. It is a local motion, a motion inherent in the particles of matter. In most substances the magnetic attraction is very slight. It is usually so in iron and nickel, but under certain circumstances the particles or molecules of these metals all seem to pull together and exert a strong attraction.

Magnetic Repulsion.

This is not the whole mystery of the magnet. It has another force, known as repulsion. If we take two magnets and hold two ends of them near each other, we feel a strong pull, a powerful desire to come together. But if we turn one of them so that its other end comes into play, we feel a push instead of a pull. Instead of attraction there is repulsion; they are seeking to push each other apart. Thus the two ends of the magnet exhibit different powers, and seem to possess opposite properties. To distinguish them we call one end the north pole (because, for some strange reason, it is attracted towards the north pole of the earth), and the other end the south pole (it being attracted towards the south pole of the earth). The principle of the magnet is that two north poles or two south poles repel each other, while a north and a south pole attract each other. What is the cause of all this no one can very well say, but the strange fact exists that a piece of iron can manifest three conditions, attracting under one condition, repelling under another, and under a third neither attracting nor repelling.

The Electro-Magnet.

There is another and highly important magnetic property of iron yet to be described. There is a difference between soft iron, which has been deprived of its carbon, and steel, or carbonized iron. Soft iron can be made as magnetic as steel, but does not retain its magnetism. Steel accepts magnetism slowly, but retains it indefinitely. And a close relation between electricity and magnetism is shown in the fact that the easiest and quickest way to make a magnet is by aid of the electric current. If a wire be wound in many turns around a piece of soft iron and a current of electricity be sent through it, the iron instantly becomes a magnet, and attracts any iron that is near it. If the current be cut off, the iron instantly loses its magnetism, and at once lets fall the iron it held, or ceases to attract the iron in its vicinity. Furthermore, if wire be curved into a spiral or solenoid and an electric current sent through it, the solenoid itself acts as a magnet. This fact, that electricity moving round a spiral acts as a magnet is very strong evidence that magnetism is a phenomenon due to motion in curves or circles; but beyond that we know very little about it.

Soft Iron Magnet.

A piece of soft iron thus magnetized is known as an electro-magnet. And an electro-magnet is one of the most valuable things that man is acquainted with. Its value lies in the quickness with which it gains and loses magnetism, for this is the principle employed in the electric telegraph and the electric motor. If the electro-magnet gained and lost its strange power slowly instead of instantaneously, we could still send messages by telegraph, but we might get less news in a day than we now get in five minutes. As for the electric motor, it would be useless under such conditions. So we can thank mother Nature that soft iron has this wonderful property and does not let go of its magnetism slowly or hold on to it permanently like steel.

One thing more may be said about the theories of magnetism. It is now thought that every molecule of matter is a magnet, being possessed of a peculiar motion that gives it this strange property. But usually each molecule seems to act independently, and the many small attractions and repulsions conflict with and neutralize each other. It is difficult to make them act together, or exert their powers all in the same direction. This is easily done only in the cases of iron and nickel, the two magnetic metals. The molecules of soft iron are supposed to yield readily to the coercive force of the electric current, turn so as to pull all together, and turn back as soon as the coercive force ceases. The molecules of steel yield less readily, but when they are once brought to act in harmony they retain this relation, and the bar of steel becomes a permanent magnet. The carbon in the steel very probably has something to do with this difference.

Electro-magnetism is one of the most important, if not quite the most important, discoveries of modern times, and before going into an account of its many useful applications it seemed desirable to state briefly what electricity and magnetism are, and to what properties their great utility to man is due. To describe them scientifically would need a volume, so we must be content with this very brief statement of their inherent characteristics before going into the story of their various applications.

History of the Telegraph.

From the earliest time, when beacons lighted on the tops of the hills were used to indicate the approach of an enemy, or the occurrence of some other important event, the power of communication at a distance has been felt to be a desideratum. Many inventions and arrangements have from time to time been made with this object, as, for example, the signals by flags, or by the old semaphore system—which is still employed for railway signalling—by ringing of bells, or by the motion of water in tubes, but none of these was applicable to any but short distances, or indeed generally applicable at all. One common method used in former times was by columns of smoke or fire; and the heliograph flashing of signals from hill to hill by mirrors and sunlight is still in use. The discovery of the conduction of electricity along metal wires, however, soon gave rise to the idea of communicating signals by means of its effects, and the electric telegraph has now become one of the most powerful agents for the promotion of civilization, and even a necessity of every-day life.

The first electric telegraphs proposed were founded on the observation of motions produced by the attractions and repulsion of statically electrified bodies. In 1747 Watson showed the transmission of a discharge from a Leyden jar through a wire stretched across the Thames; and later in the same year he caused it to pass through 10,600 feet of wire supported on insulators, which were attached to wooden posts. The first effort to convey intelligence by means of electricity was made in 1774, before the discovery of the galvanic battery and the electro-magnet. It was proposed to have a separate wire for every letter, each wire to be connected at one end with an electric machine and at the other end with an pithball electroscope. At a later date a man named Dyer, of New York, devised a scheme of telegraphing with a single wire. As the galvanic battery was not then known, the frictional machine was to be used, while the message was to be given by a point passing over litmus paper, which the current was to mark by chemical action.

But practical telegraphy waited until after the discovery by Galvani of the electric battery and current and by Oersted of the effect of the current upon a magnetized needle. The fact that the current could cause motion in such a needle led to many schemes of telegraphing, of which the only one that has held its own is the Wheatstone method in which deflections of the magnetic needle indicate the letters of the alphabet. This is still employed on the railways of England.

Morse and his Invention.

The electric telegraph now generally in use employs a different principle. In the year 1832, an American artist named Samuel F. B. Morse was on his way home from France in the packet-ship *Sully*. During the voyage a conversation took place in the cabin about some experiments that had been made just before in Paris, in which signals were transmitted over a considerable length of wire. This set Morse to thinking. If signals could be made through hundreds of feet of wire, why not through hundreds of miles? During the remainder of the voyage he sought to devise some practical method of signalling over the electric wire, and on reaching New York he began a series of experiments which lasted for years. His studio was abandoned, his pocket was often empty, and more than once he went hungry in his devotion to his idea. No one would put money in it, he was looked upon as a crank, and it took him eight years to get Congress to make a small appropriation of $30,000 for the construction of an experimental line between Washington and Baltimore.

Even then Morse's difficulties were far from at an end. He spent nearly all the money in trying to lay the wires underground. Ezra Cornell—to whom we owe Cornell University—came to his aid with an ingenious excavating machine which dug a ditch for the pipe that held the wires and filled in the earth behind it. But as they went on the current grew steadily weaker, and after ten miles were laid it failed altogether. Experiments were made, and time passed on, and nearly all the money was gone, but still the wires refused to carry the current. Then some one suggested that they should be strung overhead instead of laid underground, poles were rapidly erected, the wires were stretched across their tops, and now the current responded splendidly. Soon the wire was extended from Baltimore to Washington, and on one notable day, in 1844, the famous first message, "What hath God wrought," was sent over its full length, teaching the legislators at the National Capital that a new wonder had come into the world.

It is said that the original method devised by Morse was a very complicated series of signals, which needed a telegraphic dictionary to make out their meaning, and that the "dot and dash" system, known as the Morse alphabet, was really the invention of Alfred Vail, his partner. Also that the use of a single wire and the familiar telegraph "sounder" were due to Vail. However that be, the honor of the invention fairly belongs to Morse, and the world has been glad to give it to him, while the name of Vail has vanished into obscurity.

The Morse telegraph is properly termed an electro-magnetic telegraph. In it the electro-magnet is employed as an essential feature. It is the rapid magnetization and demagnetization of soft iron, with the successive attraction and release of the sounder, that convey to the ear the dots and dashes of the alphabet. At first it was thought necessary to trace these on a revolving roll of paper, for subsequent reading, but this was soon discarded as useless, and since then sound-reading alone has been practiced.

The Morse Alphabet.

In the Morse receiver the instrument consists essentially of a soft iron bar surrounded by a coil of wire, and a lever of soft iron below the bar, which acts as an armature. When the current passes through the wire the bar becomes a magnet and attracts the armature, which springs upward with a sharp click against a stop-screw. When the current is stopped the bar loses its magnetism and the armature is drawn quickly down by a spring. It is not the sounds, but the spaces or rests between the sounds, that form the signals. A short space is known as a dot, a long space as a dash, and each letter in the telegraph alphabet is made up of a combination of dots and dashes. This alphabet is an exceedingly convenient one, as it can be employed in other ways than on the telegraph. It can be made with a locomotive whistle, a horn, a light, a heliographic flash, and in other ways. We give the alphabet below. As will be seen, no letter contains more than four signals, while the numerals employ five signals each.

A - —
B — - - -
C — - — -
D — - -
E -
F - - — -
G — — -
H - - - -
I - -
J - — — —
K — - —
L - — - -
M — —
N — -
O — — —
P - — — -
Q — — - —
R - — -
S - - -
T —
U - - —
V - - - —
W - — —
X — - - —
Y — - — —
Z — — - -

Numerals.

1 - — — — —
2 - - — — —
3 - - - — —
4 - - - - —
5 - - - - -
6 — - - - -
7 — — - - -
8 — — — - -
9 — — — — -
0 — — — — —

On applying the Morse instrument to a long line, it was found that the current was frequently so weak that it could not move the armature, hence Morse connected with the instrument a *relay* and *local battery*. The relay consists of a pair of electro-magnet coils through which the line-current passes. The only work that these coils require to do is to draw down a light armature, and the motion of this armature, by means of a lever, closes a local circuit containing a battery and the Morse instrument. Thus on every passage of the current through the line-wire, a current is caused to flow from a local battery through the instrument, and the work required to be done by the line-current is very small indeed, being merely the motion of the key of the local circuit at the receiving end.

The Wheatstone Telegraph.

The Wheatstone system, in use on the English railways, is very different. In this a needle replaces the sounder. At first five needles were used, each worked by two wires, but now one needle and a single wire do the work. When no current is passing the needle stands upright on a dial, but the current causes it to swing to the right or left. Even this system has been invaded by the Morse alphabet, which is in use all over the world. In the needle system a swing to the left means a dot and a swing to the right a dash. These form the frequently used letters E and T, while a combination of swings forms each of the other letters.

It need hardly be said that the electric telegraph system made remarkable progress. The first business telegraph in the United States, from New York to Washington, was completed in 1845, the first in England was founded in 1846. In 1870, when the English Government bought all the telegraph lines, at a price of about $50,000,000, there were in the British Islands 60,000 miles of wire. In 1890 there were 195,261 miles. The United States in 1890 had 210,000 miles of line and 678,997 miles of wire. In 1899 the Western Union Telegraph Company had 189,856 miles of line and 904,633 miles of wire, while the Postal Telegraph Cable Company also did business, but kept its length of wire a secret. The British Islands send the largest number of messages of any nation, 78,800,000; the United States stands second with 70,000,000.

The Ocean Cables.

The land telegraph was not many years old before efforts to telegraph under water were made. It was found that the current could be sent for short distances beneath rivers, and in 1850 the first ocean telegraph was laid across the English Channel, by two men named Brett. This was a single copper wire covered with gutta percha. Soon there were others under different short bodies of water, but no one then deemed it possible to carry a wire across the Atlantic, then thought to be of fathomless depth. But in 1853 an important discovery was made. The bottom of the Atlantic was sounded from Newfoundland to Ireland, and there was found a vast plain, nowhere more than two miles deep, while it was 1600 miles long and 400 wide.

This discovery set men to thinking that an ocean cable was possible, and chief among these was Cyrus W. Field, a New York merchant, who had already built a telegraph line across Newfoundland. He went to work with remarkable energy, organized a company, and by November, 1856, had a capital of more than $1,000,000 subscribed. A cable was made in England, loaded on the American ship *Niagara* and the English ship *Agamemnon*, and in August, 1857, the *Niagara* set out from the Irish coast. But the cable broke, other accidents happened, and the task had to be given up. The next year it was tried in a different way. The two ships met in mid-ocean, joined their wires, and steamed away. Once more the cable parted, and hope was lost, except by Cyrus W. Field, who was one of the kind of men who do not give up. In July the vessels met again, spliced together their cables, and once more steamed east and west, telegraphing to each other through the wire as they went. This time the cable held, and on August 29, 1858, for the first time in the world's history, men spoke to each other across the wide Atlantic. The Queen saluted America, the President sent greetings to England, cannon roared, bells rang, bonfires blazed; but day by day the messages grew weaker, and finally ceased—the cable had failed.

The Great Eastern.

Seven years followed, a great war was fought in the United States, many scientists declared that an ocean cable was the fancy of a dreamer, and some even denied that any messages had crossed the Atlantic at all; but Field did not despair. New cash was raised, a new cable was made, and in 1865 the *Great Eastern*, the largest vessel on the seas, set out from the Irish coast, rapidly dropping the leagues of wire into the sea. On August 9th a flaw occurred; the cable was drawn up for repairs; suddenly the sound of the wheel stopped; the cable had broken and sunk helplessly into the depths. But "never despair" was Field's motto, and once again, in July, 1866, the *Great Eastern* set out laden deep with ocean cable. On July 26th she steamed into Trinity Bay, Newfoundland, landed her cable at Heart's Content, and her grand work was accomplished. The cable was successfully laid, and from that date to the present, time and space have been banished in the sending of news between Europe and America. The lost cable of 1865 was soon after lifted from the ocean bottom, spliced, and proved in good condition. Two cables crossed the ocean.

Since then the laying of ocean cables has been an almost yearly event. To-day more than a dozen cables cross the Atlantic to Canada and the United States and others to South America, while many parts of Africa, Asia, and the Pacific islands are connected by cable with the centres of civilization, so that the whole world is brought within speaking distance. The oceanic and coastwise cables in 1900 numbered 323, with a total length of 151,067 miles, and daily news reached New York from China, Manila, Australia, and a thousand other distant points.

The Cable and Its Instrument.

The ocean cable is a very different affair from the simple land wire. Strength and complete insulation are needed. The 1865 cable consisted of a central copper wire, with six others twisted spirally around it, the whole being thickly treated with a mixture of tar, resin, and gutta-percha. Over this were laid four coatings of this compound and of pure gutta-percha, then a wrapping of jute, and an outer sheath of ten iron wires, each of which was thoroughly wrapped with strands of tarred Manila rope. The total thickness was about 1¼ inches, the weight 36 cwt. per knot. In later cables many improvements have been adopted, but they vary so much that we cannot attempt to describe them.

The making and laying of the cable was not the only thing necessary. The reader will remember Professor Morse's failure in laying his first wire under ground. This was due to what is known as Induction, a checking influence exercised by the earth on the wire. In the long Atlantic cable induction became a powerful resisting agent, the currents followed each other slowly, and so little electricity got through that the ordinary sounder was not available. A far more delicate receiving instrument was needed. A very sensitive one was invented by Sir William Thomson (now Lord Kelvin), without which the cable could not have been successfully worked for commercial purposes. This consists of a magnet made of a fragment of watch-spring, ⅜-inch in length, cemented upon a small circular convex mirror of silvered glass, which is suspended by a short thread of cocoon silk. Around this minute magnet is a coil of very fine wire, and a ray of light from a lamp falls on the mirror. This ray is reflected upon a scale at such a distance that a very slight movement of the mirror makes a considerable movement of the spot of light upon the scale. These movements are read off like those of a Wheatstone needle. With the Morse sounder less than a word a minute could be received over an Atlantic cable, while the reflecting instrument gives easily fifteen words a minute, and as many as twenty-four have been received. In 1869 Thomson invented the Syphon Recorder, by which cable messages could be permanently recorded.

Overhead and Underground Lines

Telegraph lines may be either overhead or underground. The former system is used wherever possible, but in large cities many miles of underground wire have been laid. Of the 2,600 wires which enter the Central Telegraph office in London, nearly all are underground. Overhead wires are supported upon wooden (sometimes upon iron) poles, by means of insulators made of glass, porcelain, or other material through which the current cannot pass. The wire used is either galvanized (zinc-coated) iron wire, or hard-drawn copper wire for special purposes. Underground wires are laid in pipes or boxes and carefully insulated, there being flush boxes at intervals through which the wires can be reached for repairs or testing. The batteries usually employed in telegraphy are Daniell's sulphate of copper battery, the bichromate of potassium battery, and several others.

Duplex and Multiplex Telegraphy.

The first great invention in the cheapening of telegraphy was the duplex system, by which two messages could be sent at once in opposite directions over a single wire. This is done by a method of dividing the current, an ingenious arrangement of wires enabling each operator to use a special portion of the current. This system was developed by the genius of Thomas A. Edison, in 1874, into one in which two messages could be sent at once in each direction, thus constituting a fourfold or quadruplex system.

A still more remarkable invention is multiplex telegraphy, by which a considerable number of messages can be sent at once without interference over a single wire. The principle involved is to have at each end an apparatus on which rotating arms move synchronously, or in exact correspondence. When the synchronism is exact, a message sent over one arm can be received only by the corresponding one, and if there be a number of such arrangements set differently, each can be worked separately without interference with the others. This system, first suggested by Meyer in 1873, was perfected and made practical by Patrick B. Delany, of New York, in 1884, and by it the working capacity of a single wire was enormously increased.

The Art of Electrical Communication.

The state of the art of electrical communication to-day may be summed up as follows:

Telephony	60 words a minute
Single Morse circuits	15 words a minute
Duplex Morse circuits	30 words a minute
Quadruplex Morse circuits . .	50 words a minute
Multiplex (six circuits)	80 words a minute
Wheatstone automatic	125 words a minute
Wheatstone automatic duplex	200 words a minute
Wireless	10 words a minute

Undoubtedly before the new century is ten years old at least one-half of the correspondence now carried by train will be telegraphed, at an average rate for the whole country of 15 cents for fifty words, or five times as many words for one-half the present telegraph toll. It is practicable to begin this change at once, but not by present methods of operation. It is only possible by the chemical automatic system.

What the centenarian of a hundred years hence may see, a prophet should leave to his son to prophesy. In the way of telegraphy, doubtless ships at sea will hold converse with each other, and correct their chronometers with the last observation a hundred miles away. They will be in constant communication with the shore through the air, though the trip from the Hook to the Lizard may then be made so rapidly that only the overanxious will want a dispatch.

Printing and Automatic Telegraphs.

Various other inventions have helped to perfect telegraphy. An important one of these is the Hughes Type-printer. In this the sender is like a piano keyboard, with the letters engraved upon the keys, and the message is received in plain printed characters. But the mechanism is so complex and sensitive that only the most skillful operators can handle it. There are several other printing systems in use.

In all the apparatus described the message must be sent by hand, and even by the sounder, the fastest hand instrument known, the most expert operator cannot send more than forty-five words per minute. But the electric current is capable of performing far more rapid work than this, and there are a number of automatic systems in use that can be operated with extraordinary speed. But it is necessary to prepare a paper transmitter in which the message is punched with holes representing letters, and the time and cost of preparing this is the defect of the system. When ready it can be run through the machine at a speed of over 400 words per minute. But this is very slow as compared with a system credited to two Hungarian engineers, Pollak and Virag, in the year 1899. Their system employs as receiver a reflecting mirror, like that used in cable telegraphy. The beam of light, swinging to right and left, falls on a sensitive slip of photographic paper moved by clock-work, and is thus recorded. There is claimed for this instrument a speed of about 1600 words a minute. But, as in all automatic systems, the time gained in sending is lost in preparing and translating, and the old-fashioned Morse sounder does not seem likely soon to be banished.

Wireless Telegraphy.

It is no new fact that telegraph messages can be sent without the aid of wires. Prof. Morse sent messages across a small river, having batteries on one side and magnets on the other, and wires on each side parallel to each other and connected with buried copper plates. By a similar process in 1893 messages were sent a distance of three miles, and later for four and one-half miles. In these experiments the principle of electric induction was used. In 1895 the powerful Hertzian waves were employed, in which the electricity seems to stream out like a fluid through miles of air. In 1896 Marconi, an Italian electrician, invented a method in which he found that these waves spread out in all directions, and would act on receiving instruments placed all around at a considerable distance away. His first messages were sent about a mile, but since then he has sent them across the English Channel, and for many miles in other localities. What the end of this new and wonderful process will be it is too soon to predict, but it is likely to prove useful in a hundred ways in the coming time.

The Discovery of the Telephone.

Wonderful as is the telegraph, with its power of transmitting instantaneous sound signals over thousands of miles of distance, still more wonderful is a later discovery—the telephone,—by which the very tones of the human voice are similarly transmitted. The first discovery in this direction was made in 1861 by Johann Philipp Reiss, a German professor, of Friedrichsdorf, who exhibited his telephone at Frankfort on April 25th of that year. His discovery embraced all the essential features of the existing telephone, but he sought in vain to induce scientists to pay attention to it, and he died in 1874 a victim of disappointment and distress of mind. But his idea was not lost. Others took it up and developed it into a more practical system. Chief among these were Elisha Gray, of Chicago, and Alexander Graham Bell, of Boston, both of whom entered their discoveries at the patent office on the same day. On February 14, 1876, Professor Gray filed a caveat of his invention and Professor Bell applied for a patent on his. Bell gained the priority, a fact worth millions of dollars to the inventor. The Bell telephone, which was first exhibited in a retired corner of the Centennial Exposition at Philadelphia in 1876, has now its hundreds of thousands of miles of wire in the United States. Among the others who aided to perfect the telephone may be named Prof. C. E. Dolbear, of Tuft's College, Massachusetts, and Thomas A. Edison.

In regard to the question of priority, it is generally conceded that Prof. Gray was much in advance of others with successful experiments, but Prof. Bell was the first to perfect his invention and secure a full patent. On February 12, 1877, his telephone was tested between Boston and Salem, and found to convey vocal sounds from one place to the other, a distance of eighteen miles. Edison's carbon "loud-speaking" telephone was brought out in 1878, and proved of inestimable value. Since then, there have been many improvements in the different parts of the telephone, and it has become a daily feat to carry on a conversation between New York and Chicago, nearly 1,000 miles away.

The Principle of the Telephone.

It need hardly be said that the sensation we call sound is due to the action of the vibrations of the atmosphere upon the tympanum or drum of the ear, a thin stretched membrane. The telephone employs a kind of artificial ear, consisting of a stretched membrane, which is repeated at each end of the wire, one accepting the sound, the other reproducing it. The voice of the speaker falling on the receiving membrane, causes it to vibrate in the same manner as the drum of the ear. The effect of the vibrations is to cause a rapid making and breaking of an electric current which traverses a telegraphic wire, and these electric waves in turn act upon a diaphragm or tense membrane at the receiving end, causing it to vibrate in the same manner. The sounds which caused the first vibration are imitated by the second and fall upon the ear of the listener as vocal utterances.

This instrument at first was very imperfect. The most that Reiss could do was to reproduce the pitch of the vocal tones. Gray succeeded in producing their intensity also. Edison added an important principle. He discovered that carbon possesses the valuable property of changing its resistance to the electric current with every variation in pressure. Thus, instead of an incessant making and breaking of the current, as in the old method, in his system the current simply varies in intensity. The membrane vibrates against a disk of carbon, every vibration modifying the pressure and therefore changing the strength of the current. As a result the membrane of the receiver repeats all the fine shades of vibration in that of the transmitter, and the voice is reproduced with all its individual characteristics. Instead of hearing mere lifeless sounds, one can now easily recognize the speaker—by the tones of his voice. The microphone, the discovery of which was claimed by both Edison and Berliner, is the basis of the carbon telephone, since in it the principle of carbon pressure was first employed. It is also employed as a relay in receiving telephones, its advantage resting in its power of magnifying faint sounds. In the microphone a loose piece of carbon touches another in a telephone circuit, the jarring of the loose carbon causing a rapid variation of pressure and electric current, and magnifying the original sound. When it was first introduced, experiments were made in which the sounds of a fly's feet in walking could be very distinctly heard.

The Telephone Receiver.

It need scarcely be said that the carbon disk cannot be made available at the receiving end of the telephone, and that a different apparatus is necessary to cause the requisite vibration at this end of the circuit.

This apparatus consists of a small electro magnet in connection with a thin disk of iron, fastened at its edges and free to vibrate at its centre. Every variation in the strength of the current reduces or increases the attractive power of the magnet and thus varies the influence exerted upon the diaphragm, causing it to vibrate in close sympathy with the vibrations of the transmitter, the sounds of the voice being thus very closely reproduced. It must be borne in mind that the sounds are not actually carried, but are reproduced by the rattle of a thin piece of iron close to the listener's ear, whose effect is to give the vocal tones in close exactness. The volume of the speaker's voice is not reproduced. That has so far proved impossible. The sounds received are much lower, yet quite clear and distinct when the receiving instrument is held close to the listener's ear.

Development of the Telephone Service.

In the United States the American Bell Telephone Company gained an early monopoly of the telephone service by buying up all competing patents of importance. The first patents began to run out in 1893, but there remained patents on switch-boards and other accessories necessary to the business, and the Bell corporation still holds control. One important invention of recent date does away with the necessity of calling up the central office and announcing the number of the transmitter. Now, as soon as the instrument is taken from its hook, a visible signal on the corresponding section of the switch-board reveals the fact and number, and it is only necessary to state the number with which connection is desired. This, if the number is not already in use, is at once made by the active assistants at the central office, and the two persons who wish to hold a conversation are placed in direct communication, though many miles of space may separate them.

The telephone has marked advantages over the telegraph, arising from the fact that an intermediate operator, often at a considerable distance, is not necessary. Each subscriber has his individual wire, entering his office or house, and the instruments for sending and receiving no longer need to be shut up in a corner closet, but may stand on his desk at his elbow, to be picked up and used as often as needed. Thus a man sitting in his office or a woman in her parlor may in an hour's time carry on brief conversations on social or business matters with persons many miles distant in various directions who otherwise could be communicated with only by dint of much time and many journeys or by the slow method of the mail. As a time-saver the telephone stands first among modern discoveries, and without its aid the present activity of business would receive a serious check.

Long Distance Telephone.

Long distance telephony was first begun in the United States in 1883, in which year a line was operated with success between New York and Cleveland, Ohio. The conducting power was greatly increased by the use of a large copper wire, and the difficulty due to imperfect insulation was gradually overcome, so that the voice could be heard with distinctness for that distance. In 1892 New York and Chicago 930 miles apart, were successfully connected, and this line was afterwards connected with the Boston line, making a distance of 1259 miles. Almost all the large cities of the United States are now connected by long distance telephones, as are also the leading cities of Europe. It is perhaps but a question of time when the voice of man will be heard from America to Europe under the broad Atlantic.

Telephone Statistics.

The following are the latest statistics made public by the American Bell Telephone Company, which practically monopolizes the telephone business of the United States. The figures are for January 1st, of each year:

TABLE SHOWING THE GROWTH OF TELEPHONE SERVICE:

	1897.	1898.	1899.	1900.		1897.	1898.	1899.	1900.
Exchanges	967	1,025	1,126	1,239	Miles wire submre	2,818	2,675	2,973	3,404
Branch offices	832	937	1,008	1,187	Total miles of wire	536,845	626,400	772,989	1,016,776
Miles of wire on poles	286,632	327,315	396,503	509,03	Total circuits . .	264,645	295,904	338,293	422,620
Miles of wire on bld'gs	12,594	13,776	15,329	15,087	Total employés .	14,425	16,682	19,668	25,741
Miles of wire underg'd	234,801	282,634	358,184	489,25	Total stations . .	325,244	384,230	465,180	632,946

The number of instruments in the hands of licensees under rental at the beginning of 1900 was 1,580,101. The number of exchange connections daily in the United States is 5,173,803, or a total per year of over 1,666,000,000. The average number of daily calls per subscriber was 8 2-10. The capital of the company is $25,886,300.

The long-distance company had January 1, 1900, 12,006 miles of pole line and cable, and 150,380 miles of wire connecting 323 offices.

On January 1, [illegible], Germany had [illegible] telephone stations; Sweden and Norway, [illegible]; France, [illegible]; Russia, [illegible], all Continental Europe, 465,180; Great Britain (1899) 103,084; United States (1900), 632,946.

As will be perceived, the United States has made far the most rapid progress in telephony, its number of stations equalling that of the whole Continent of Europe.

The Phonograph.

The investigations into the telephonic principle led to another discovery, in its way still more wonderful, though as yet of less practical utility, made by Mr. Edison in 1877 and announced to the public in the following year. This was the seemingly magical Phonograph, in which the voice is not sent over a wire, but is sealed up in a casket, to be released for the benefit of future audiences. By its aid the voice of the orator or singer of to-day may be heard in all its varied tones and inflections ten or twenty centuries hence, ages after the very existence of the speaker or singer may have been forgotten.

The principle of the phonograph is a simple one, wonderful as are its results. Though due to studies in electrical phenomena, electricity has nothing to do with it, it being merely a method of producing vibrations in a tense diaphragm, as in the telephone, and causing those vibrations to permanently record themselves. In the phonograph a small brass cylinder is caused to turn on a metal shaft, and arranged to travel horizontally on a spiral thread cut in the shaft. On the surface of the cylinder is stretched a sheet of tinfoil, and in front of it is a mouthpiece, with a very thin metal plate or diaphragm at its bottom, to which is attached a round steel point. This point touches the foil, and when the diaphragm is made to vibrate by words spoken into the mouthpiece it is pressed into and scratches the foil. By turning a crank attached to the shaft, the cylinder is caused to rotate and move horizontally, and as words are spoken into the mouthpiece the sharp steel point makes a spiral series of indentations in the foil, of varying depth and character, in accordance with the strength and rapidity of the vibrations produced.

If now the cylinder be brought back to its starting point and a resonator be put in the place of the mouthpiece, the words and tones of the voice can be closely reproduced. The steel point is held by a screw against the foil, and as the cylinder rotates the point retraces the indentations from end to end, causing the diaphragm to vibrate in the same manner as before, and producing similar vibrations in the air. These vibrations from the resonator sound like spoken words, and if the crank be turned exactly as originally, the exact pitch and tone of the voice will be given back.

In the development of the phonograph several improvements have been made. An electric motor is used to turn the crank; wax replaces tinfoil in the cylinder; bifurcated ear-tubes are used for hearing, and progress has been made in other directions. One of the later developments is the graphophone, from which, by the aid of a large trumpet, the record of the phonograph can be transmitted to the ears of a large audience, without need of the eartube or other contrivance. In this a preparation of wax and paraffine is used, in which the fine steel point cuts a minute hair-line, scarcely visible to the naked eye, yet capable of giving a reproduction of a song, a speech, the sound of a musical instrument, etc., with remarkable exactitude.

Electro-Metallurgy.

Hitherto we have dealt with the methods of conveying intelligence by electrical and other agencies. We have next to deal with some other results of electric power. One of the earliest applications of the galvanic battery lay in the decomposition of chemical compounds of metals by the current, and the deposition of the pure metal for plating or other purposes. In the electro-plating process a solution of cyanide of silver is employed, and a current of electricity sent through it from a battery. A plate of silver forms the positive electrode and the articles to be plated form the negative. The electric current decomposes the cyanide, the silver is deposited in a thin film on the articles to be plated, and the cyanogen is set free at the silver plate, which it begins to dissolve, forming new cyanide of silver. With this the process is repeated, and it can be kept up while any silver remains, so that the article can be covered with a coating of silver of any desired thickness, and firmly attached to the interior metal.

Electro-gilding, or covering with gold, is performed in the same manner, and other metals can be similarly deposited by the battery action. Among the most common of these processes is that of plating with nickel, also the covering of iron with zinc, producing what is known as galvanized iron. In this operation a solution of sulphate of zinc is employed.

Electrotype.

A highly important application of this principle is to be seen in the electrotype, in which copper or other metals are deposited upon moulds of coins, types, engraved blocks, medals, etc., of which faithful copies can be produced. The method was invented in 1837 by Professor Jacobi, of St. Petersburg. In a bath composed of sulphate of copper electrolytic action will decompose this compound, the copper being deposited upon a mould of the article to be copied, while the oxygen of the decomposed water forms oxide of copper with the copper of the positive plate. The oxide unites with the released sulphuric acid to form new sulphate of copper, and this is again decomposed, the process being successively repeated. One of the most important applications of this process is to prepare a duplicate in copper of pages of type, and thus release the type for other use. Engraved copper plates can be multiplied indefinitely, wood cuts be reproduced in copper, etc.

Medical Use of Electricity.

The use of electricity as a remedial agent is by no means new, and its employment is increasing. It is applied in three forms, the static, the galvanic, and the inductive, or Faradic. Static electricity, that of the old frictional machines, is little employed of late years, but the current from the galvanic battery is largely used, some form of the bichromate cell being commonly adopted. As the current has to traverse the skin, whose electrical resistance is high, a battery composed of a considerable number of cells, say from thirty to fifty, is deemed necessary. For the ordinary treatment of muscles, nerves, etc., disks, plates, or cones of brass or carbon, covered witn flannel or wash leather, are applied to the skin; but if strong currents are used, large pads of moist clay, flannel, or sponge, ten inches or more in diameter, are necessary, a platinum or steel needle centring the current upon the part to be heated. With such a terminal a current of two hundred milli-amperes can be borne without inconvenience, but if the terminal be reduced to an inch in diameter, intense pain and rapid destruction of tissue may follow. As this is what is needed in the removal of tumors, strong currents and small terminals are employed.

In the employment of the Faradic method, the thick primary coil induces an alternating current in a secondary coil of fine wire, while a bundle of iron wires is used to strengthen the current by its magnetic action, it being slid in and out of the coil as variation in strength is desired. The currents from a Faradic machine thus alter nate in direction, and can be readily varied in strength.

Benefits of Electrical Treatment.

There are a number of nervous affections, such as chronic neuralgia, chorea, hysteria, and others, in which static electricity may be usefully employed. For acute neuralgic pains, such as sciatica, tic-douloureux, etc., the galvanic current is used, also for atrophy of muscle following hemiplegia, diabetes, and other affections, in spinal irritation, lumbago, the stiffened joints from chronic rheumatism, chronic pharyngitis, glandular laryngitis, chronic tonsilitis, and other diseases arising from chronic inflammation and defective nutrition. The Faradic current is found to be of value in cases of nervous exhaustion attended with insomnia, in functional disorders of the generative organs, in acute articular rheumatism and in various other disorders of the articular and nervous system.

Electricity may be very usefully employed in the removal of abnormal conditions of tissue, such as nævi and aneurisms. Needles insulated nearly to their points are thrust into the tumor, and the current is sent through them, the result being to coagulate the contents around the needles, obliterating the nævus, or strengthening the walls and filling in the sac in an aneurism. By the use of a powerful current most cases of uterine hemorrhage may be checked, the positive current being carried by a thick platinum current to the mucous membrane of the uterus, while a large surface electrode lies on the abdomen. Fibroid tumors of the uterus are subjected to similar treatment, as also various inflammatory conditions of this organ. As regards the use of "galvanic" or "magnetic" belts, from which many benefits are claimed, these benefits are far from apparent. It may be said that magnetism, however powerful, has no evident influence upon the human body.

In addition to its uses as a curative agent, electricity has also been usefully applied in surgery. A powerful current sent along a thin wire develops heat in such a quantity that the wire soon becomes white hot, constituting the primary form of the incandescent electric light. Such a wire can be used in galvano-cautery, to cut or burn off, and at the same time to cauterize, excrescences and growths which could not be easily reached except by a tube and a small loop of platinum wire. Also a little incandescent lamp, whose bulb is no bigger than a pea, is employed to light up and explore cavities,—even those of the throat and stomach,—a use of great promise in the art of saving life and avoiding suffering.

Electricity in Agriculture.

The physiological and anatomical action of electricity is not confined to the human body, but has been applied in plant growth, with beneficial effects. Both atmospheric and terrestrial electricity have been shown to favor the germination of seeds and the increase of plant tissue. In the use of atmospheric electricity tall poles are used as collectors and conducting wires ramify through the soil, with the result, as some claim, of increasing the yield one half. Professor Spechneff, of Kiev, claims that by the use of such an apparatus he obtained an increase in grain crops of from 28 to 56 per cent., and from 16 to 60 in weight of straw, while potatoes showed an increase of 11 per cent. By electrifying the earth the root harvest was made four times greater and that of leaves two or three times. When the seeds were electrified before planting their growth was nearly twice as rapid. In the United States similar experiments have been tried with varied results. Garden vegetables were in some cases spoiled, and in no case clearly benefited. The use of the electric light at night largely increased the growth of plants, but the interference with their periodical times of rest appeared to be injurious. It has been found that the influence of electricity is beneficial to flowers, which bloom much sooner and show finer and more brilliant coloring. In this case glass must be interposed between the light and the plant. What will be the ultimate result of these experiments, it is too soon to say, but it seems very probable that such an artificial stimulation of nature's processes is likely to be followed by a reaction, such as is apt to follow stimulation in animals, and that in the end there will be no beneficial gain in vitality or productiveness.

The Electric Light and Electric Motor.

We have given a number of highly important applications of electricity, all of which are due to the two older sources of electric energy,—the frictional machine, with its development of intensity of current, and the galvanic or voltaic battery, with its development of quantity. But for some of the more valuable electrical results, such as the electric light and electric motor, a new and more powerful source of electricity was needed, and this in due time was discovered, as an interesting outcome of electro-magnetism. The utility of the magnet both in telegraphy and telephony has been shown. In the new source of electric power it is indispensable, the dynamo being based upon a peculiar and highly useful relation between magnetism and electricity.

This relation is no recent discovery. It has long been known that on the approach of an armature to the poles of a magnet a current of electricity is induced in it, and that on its withdrawal from the poles a similar current, but in the opposite direction, is induced. If the ends of the armature be connected by a wire, these currents will flow through it and complete the circuit, however long, and their presence can be readily perceived by the use of the galvanometer, or by other means. There appears to be a measure of resistance in the magnet to the motion of the armature, and it is believed that the force necessary to overcome this resistance is converted into electricity within the iron moved, and is the source of the current that appears. If the operation be reversed, the armature being fixed while the magnet approaches or recedes, the same effect takes place, temporary currents being induced. This principle, simple in its statement, has proved of immense importance, for to it we owe the now familiar dynamo, in use wherever large amounts of electricity are to be generated.

The Development of the Dynamo.

For the discovery of the principle above described we must go back to the days of Faraday. The first to apply it in a machine was an Italian named Pixii, in 1832. He mounted a horseshoe magnet on a shaft and made it revolve before two soft iron cores wound with wire, their ends being opposite the poles of the magnet. Afterwards he rotated the iron cores, and left the magnet fixed, as an easier process. As a result, he obtained rapidly alternating currents of electricity, changing in direction as the armature approached and receded from the poles of the magnet.

This apparatus was afterwards improved by combining a number of magnets and adding to the number of cores or armatures. In 1857, Professor Siemens, of Berlin, began to wind the wire from end to end of the armature, instead of round and round like a spool of thread, as before, the armature being now set crosswise to the legs of the horseshoe magnet. Other important inventions followed. The alternating currents were made to flow in one direction by means of the commutator, a device for shifting the opposed currents that came from the armature into one continuous line. Subsequently Pacinotti, of Florence, devised a "ring armature," in which the current flowed in one direction without the need of a commutator. Dynamos built on this principle are still extensively used for many purposes. Another highly important invention was made in 1866 by Wilde, of Manchester, England. After the current had been produced, he carried it back into coils of wire around the arms of the magnet, which at once grew more powerful. This increased the strength of the current, and this in turn gave new power to the magnet, until it had reached its highest possible strength.

Up to this time permanent steel magnets had been used, and the machines were called magneto-electric. Wilde's invention led to the discarding of these in favor of the soft iron electro-magnet, and the machine was afterwards named the dynamo-electric, a compound which soon became shortened to the one word, dynamo. It was this invention which made possible the huge field-magnet of the modern dynamo, which is not a magnet at all, in the strict sense. There is, indeed, some slight degree of magnetism in almost every piece of iron, enough to make a very faint current in an armature. Weak as this may be, it acts through the coils upon the soft iron core of the magnet, slightly increasing its magnetism. The current at once grows somewhat stronger, and this adds a second increment to the strength of the magnet. Thus, step by step, the current increases in strength and the great iron field magnet gains a more powerful attraction, soon reaching its highest power, and yielding a current enormously stronger than that with which the process began.

The Developed Dynamo.

Such were the steps of invention which led to the dynamo, that wonderful source of modern power. It was not practically known until 1870, when Gramme invented his continuous current ring armature, a machine much more powerful than any preceding one. As late as 1873 the word "dynamo" was not known, and magneto-electric machines were still talked of. Since then Edison, Weston, Thomson, and others have been busy in developing the machine which had thus slowly come into existence. In its use one fact clearly appears—nature never gives something for nothing. The dynamo gives back only the power that is given to it. It needs power to drag the armatures away from the attraction of the magnets, and as the machines increased in size some source of power greater than man's became necessary. The steam engine was early employed to whirl the armature rapidly before the poles of the magnet, and in the great dynamos now in use engines of hundreds of horse-power are needed to overcome the immense resistance and to yield the great speed of rotation employed. More recently the vast power of the cataract of Niagara has been applied to this same purpose.

In present usage various forms of armature are in existence, such as the ring, the drum, the disk, the pole, and the spherical types. The latter, in which the coil is wound on the surface of an iron sphere, is the form employed in the Thomson-Houston machine. In the earlier machines the whole current was passed through the coils of the magnet, but, as a rule, only a part of it is now thus utilized, this proving abundantly sufficient to develop its magnetism. In addition to the continuous current dynamos there are many forms now used with the alternating current, the commutator being omitted. These are of importance from their use in connection with transformers in electric lighting. In the application of power through the medium of the dynamo some degree of loss is inevitable, but in good machines 90 per cent., or even more, of the driving power is preserved.

The Electric Motor.

What we have told is only half the story of the dynamo. Its purpose is to convert mechanical into electrical energy. To make this useful the reverse operation, that of converting electrical into mechanical energy, is necessary, and for this the electric motor is employed. The latter is simply a reversed dynamo. As a revolving magnet or armature causes an electric current to flow in the wire coils of the latter, so this current, passing through the coils of a second armature, forces this or the magnet associated with it to revolve, and with an energy capable of giving motion to connected machinery. A familiar example of this is the vigorous motion of the electric street-car, whose motor is simply a dynamo, varied in form and reversed in action to adapt it to its special purpose.

Faraday long ago showed that such a reverse action was possible, and various machines were made that did work on a small scale. It it said that the first was made in 1847 by an American named Moses G. Farmer. But it was not until after the invention of the Gramme machine that the full significance of the principle was observed, and then almost accidently. At the Vienna Exposition of 1873, there was a Gramme machine which it was intended to operate by a primary battery, in order to show that a battery current could operate a machine. There was also a second machine present, its purpose being to generate a current. But the primary battery happened to be wanting at the time for opening, and the perplexed electrician,—a Frenchman named Hypolyte Fontaine,—not knowing what to do, conceived the idea of connecting the two machines, and of working one of them with the current developed by the other. He borrowed a piece of wire from a friend and joined the two machines. The operating machine was connected as a motor with a pump, and to his utter surprise it went to work so energetically that the water was thrown over the sides of the tank. Here was more power than he had dreamed of, and he was obliged to use a much longer piece of wire, in order by its resistance to the current to bring the motor down to milder action. He had discovered not only the electric motor, but had demonstrated the extremely important fact that great power can be carried to a distance over a thin wire, and there employed to set machinery in motion. To-day power is thus conveyed from Niagara to Buffalo, and much farther in some other localities.

It is not our purpose here to describe minutely the forms of dynamos and motors in use. They are so numerous and varied that, to do so, would be to take far more space than we have at disposal and to deal in unwieldy technicalities. It must suffice to say that the dynamo is now very widely employed for the purpose of generating light and power, and varies in size from the small machine needed to light a single building to the huge ones installed in the Niagara power-plant, where there are some twenty dynamos, each developing 5,000 horse-power. These generate the alternating current, as this proves capable of conveying electricity for long distances with much less loss than in the case of the direct current.

The Electric Light.

There are two great purposes to which the powerful currents yielded by the dynamo are applied, the electric light (with electric heat as a secondary result) and the electric motor, with its many applications to the movement of machinery. Of little less importance to mankind is the electric furnace, which has of recent years proved of great utility. In the first named of these, the electric light, we are dealing with no new discovery. The principle of the incandescent light was discovered early in the nineteenth century, when it was found that a fine wire could be heated to incandescence by the passage of a voltaic current. The principle of the arc-light was known much earlier. It is embodied in the electric spark, which was the one evidence of the existence of electricity known in ancient times.

Setting aside natural phenomena, as the lightning and St. Elmo's fire, and all mere experiments with the electric spark, the first inventor of the electric light was Sir Humphrey Davy, who in the early part of the nineteenth century produced the arc-light with a battery of 2,000 cells. The mode of producing this light is as follows: When the terminal wires of an electric battery are brought together and then separated slightly an intense, bright light between them results, and this, because of its curved form, is called the electric arc. This light, in temperature as well as brightness, exceeds all other artificial sources of heat; by its means the hardest substances, even the diamond, being entirely consumed. The wires of the battery were seen to melt and drop off in globules, but it was found that hard carbon points on the wires would prevent this, as well as increase the intensity of the light. Davy used pieces of charcoal. Foucault, in his experiments in 1844, used carbon from the retorts of gas-works, which is much harder. Foucault's improvement led to the first practical use of the electric light. It was used to illuminate the Place de la Concorde, in Paris, being placed on the knee of one of the statues there, and amazing all beholders with its brilliant power. The carbon points, though not destroyed as rapidly as wire, yet of course must waste in the consuming heat of the light. In time the distance between them is increased until the light is interrupted, and they must be brought together again to renew the illumination. Thomas Wright, of London, invented the first apparatus for moving the points automatically toward each other, a feature which now belongs to several forms of electric lighting. As it has been found that the positive carbon wastes more rapidly than the negative, that point is made to move over a wider space than the other in the same interval of time.

In 1855 Jules Duboscq's electric lamp—thus far the most perfect of the kind—was shown at the Paris Exhibition, and Professor Tyndall, of England, adopted it for the illustration of his lectures on light and colors. In 1858 the works of the new Westminster bridge, London, were illuminated by Watson's electric light, and the following year the magneto-electric light, invented by Professor Holmes, was successfully tried at the lighthouse at Dover. In 1861 the French Government provided for the illumination of eight coast lighthouses by the electric light.

The Arc-Light.

Fifteen years passed before anything further of importance in the development of the arc-light was achieved, but in the year 1875 a Russian electrician of ability, named Paul Jablochkoff, on his way to the United States to visit the Centennial Exposition, stopped at Paris, where a noted chemist placed at his disposal a large laboratory. Here, in a few months, he made a great sensation, by his discovery and exhibition of the electric candle. In this the two carbons of the arc-light were placed side by side, insulated from each other, except at their extremities, by a fusible insulating substance, which encased and separated them. As the carbons wasted under the influence of the light, this substance also burnt away, leaving the upper ends of the carbons constantly exposed at the same distance apart. The light of these lamps was soft and steady, while very brilliant, and a large number of them soon came into use in Europe.

Up to the time mentioned the galvanic battery was the only source of the current used in the electric light, and was much too costly an agent for this light to come into common use under its auspices. The discovery of the dynamo made a revolution in this industry, the arc-light was greatly cheapened, and from that time forward the progress of this light has been steady and rapid. Previously only a single lamp could be used with effect in a circuit. If two were introduced, the pair gave less light than a single one. In 1879, C. F. Brush, of Cleveland, demonstrated that with properly constructed dynamos and lamps almost any number could be placed in a circuit, it being simply necessary to increase the strength of the current for every new lamp introduced. If one arc needed 50 volts, two would need 100, three 150, and so on. If large arcs are to be produced there are needed large carbons, sometimes as much as three or four inches in diameter, and using currents of 100 or 200 amperes in energy. The common street-light seldom yields more than 800 candle-power, but a large search-light may yield a glow equal to fifty million candles. This light, placed in the focus of a large parabolic reflector, can be turned in any direction, and may be seen, in a clear atmosphere, 100 miles or more away.

There are numerous varieties of arc-lights now in use, some of them having the carbons parallel, as in the Jablochkoff candle, others being regulated, like Wright's early invention, by clockwork or other means, which keeps the carbons at a fixed distance apart. The varied adaptations of this principle are covered by numerous patents, of which the best known in the United States is the Brush light. The details of clockwork for moving forward the carbon rods as they are consumed are too technical to be given here. There is another style of lamp in which the carbons are inclined to each other, and some very successful lamps, as the Soleil, are made on this plan.

The development of electric lighting, alike in America, Europe, and other civilized lands, has been enormous, and some of our cities are very largely lit up with this powerful agent of illumination. While exact figures are not to be had, it may safely be said that over 500,000 arc-lights and more than 20,000,000 incandescent lamps are now in use in the United States, the capital invested in this business being placed by conservative authorities at $1,000,000,000.

The Incandescent Light.

If we send an electric current through two wires, one of iron and one of copper, of the same length and thickness, the iron wire may become so hot as to yield a bright glow, while the copper wire is scarcely heated at all. This is due to the fact that copper is a far better conductor of electricity than iron. A poor conductor resists the passage of the current, part of which is changed from electricity into heat—from one mode of motion into another. Early attempts, then, to make an incandescent electric light consisted in sending the current through a fine wire, of poor conduction and high resistance, the heat generated increasing as the current grew stronger and the resistance greater.

As the high heat produced soon rendered metals unsuitable for this purpose, from its tendency to fuse them, Mr. Starr, of Cincinnati, in 1845, tried a fine wire made of carbon. This gave a bright glow, but it soon burned out. Then he sealed the carbon wire in a glass globe from which the air was exhausted. This, by removing the oxygen, prevented combustion, and the incandescent lamp was achieved. But the galvanic battery could not furnish the necessary current at a low enough price, and the invention was forgotten. It was not until after the arrival of the dynamo that the idea was revived, or rather rediscovered, a fine filament of carbon being enclosed in a hermetically sealed glass bulb from which the air was exhausted.

Chief among those who attacked this problem was Edison. In 1879 he set himself to the double task of making a lamp that would give a definite candle-power, and of dividing and distributing a current between numerous lamps on one circuit. After experimenting with a large number of vegetable fibres, he selected bamboo as the most suitable substance. By means of machinery the bamboo is divided into small fibres, which are pressed in U-shaped moulds and then carbonized in ovens. They are then attached at their ends to platinum wire, and placed in the glass bulbs, the platinum being fused into the stopper of the bulb and connected with the copper conducting wires outside. Such is the general principle of the incandescent lamp. Other inventors use other sources of carbon, and in some instances the bulb, instead of being exhausted, is filled with nitrogen or other non-supporter of combustion. The Swan lamp uses cotton fibres soaked in sulphuric acid and carbonized, the Maxim lamp Bristol paper, the Lane-Fox lamp hemp fibres, the Bernstein lamp—one of the most brilliant—silk carbonized in coal-dust. But in no case are the filaments permanent. They are gradually consumed, and after about four hundred hours' use a new lamp usually needs to be introduced.

The second problem attacked by Edison, that of dividing the current between the lamps, he solved by connecting every lamp to both wires from the dynamo, so that each should be independent, the wire feeding them crossing between the dynamo wires like the steps in a ladder. This is known as "parallel distribution." In the opposite method of "series distribution" the lamps are so placed that the whole current goes through each. In the first system any lamp may be turned on or off without interfering with the others, the current from the dynamo varying with the number of lamps lighted. In the second, the current varies with the number of lamps in the circuit, as it must traverse them all. It scarcely needs to be said that the current is turned on or cut off by means of a key, the turning of which serves to light or extinguish the lamp.

Other Methods of Electric Lighting.

The above are not the only methods of producing light from electricity. If a current be discharged through a glass tube whose vacuum has been made very complete, a glow of light appears. Geissler's tubes are of this kind, though the amount of light they yield is small. MacFarlane Moore, of New Jersey, has lighted large vacuum tubes, several feet long and two or three inches in diameter, by sending very rapid discharges of strong currents through a vacuum. A very high electric pressure is produced, the tube shining with a light of thirty or forty candle-power. Tesla, by the use of his enormously rapid alternations of powerful currents, has made wonderful exhibitions of the electric glow, which flows brilliantly from the end of a single wire, and he thinks it possible in the future to suffuse a whole room with such a glow of electric illumination. But as yet no practical result has arisen from these varied experiments.

Electric Power and Its Transmission.

There are at present in use two sources of electric power, the dynamo, which utilizes the energy of steam or water, and the storage battery, based upon chemical action. The former is the one most in evidence. It is applied to a large number of purposes, chief among which is electric traction. Aside from this, numerous small machines, of varied kinds, are run by electricity, and motors, small or large, may be employed for almost any purpose to which the steam engine is applicable, varying from the small power consumed by an electric fan to the 1,000 horse-power Baltimore locomotives. The vast power, aggregating 100,000 horse-power, of the Niagara Falls electric plant is utilized in operating machines of varied kinds, largely situated at Buffalo, some twenty miles away. This distance is much exceeded in other localities, one plant in California generating electricity from water-power, and transmitting it for use to a distance of 83 miles. Wherever a dynamo can be installed, a distributing centre of power may be provided. The first-class battle-ships *Kearsarge* and *Kentucky* manufacture their own current and use it in all parts of their internal organization, electric motors doing everything, from steering the ship to handling the huge guns and the turrets that contain them.

The Storage Battery.

It must be noted that the term "storing electricity" conveys, usually, an altogether erroneous idea to the uninitiated. They are apt to conceive of it as pouring electricity into some receptacle, as we pour oil into a lamp, to be used when needed. But, in fact, electricity is an energy, not a substance, and therefore is not capable of storage in the ordinary sense. What is really done by the "storage" apparatus is to convert electricity into chemical energy, under such circumstances that, by proper arrangements, it may be readily converted back into electricity. The secondary batteries used for the storing purposes are more correctly termed accumulators. The first battery of this kind was made by Ritter about 1840, and it consisted of a series of disks of a single metal, alternated with cloth or card moistened in a liquid by which the metal would not be affected chemically.

In 1859 Mr. Gaston Planté made a secondary battery, for which he used plates of lead. Passing a current through these, lead oxide was deposited, and, after the charging current was removed, the lead and lead oxide were found to yield a very slight current. To increase this Planté devised the plan of first charging the plates, then discharging, then charging again with the battery current reversed, and so on, until, by repeated oxidations and subsequent reductions of the oxidized material, very porous plates were made. These, by their porosity, exposed a large surface to the oxidizing action of the current, so that a small porous plate took up as much electricity as one of large superficial area. Planté found that by connecting a number of cells together, and, after charging them, arranging them in series—that is, the positive plate of one connected with the negative plate of another, and so on—he could store for use quite powerful currents of electricity.

In 1880 another electrician, M. Camille Faure, devised the plan of coating Planté's lead plates with red lead, and then encasing them in flannel. The advantage of the red lead is that it is very quickly made porous, and therefore the process of repeated charging of the plates, known as the "forming" process, was reduced from weeks to days, and even to hours. This discovery, by reducing the time and expense of making the secondary battery, gave it a commercial value that it never had before, and it was hailed as a great advantage. Since that time a number of patents have been obtained for storage batteries, and they now exist in different forms, but generally modeled on the inventions of Planté and Faure. The efforts of inventors have been mainly directed toward reducing the weight of the cells, and to devising new ways of holding the red lead on the plates; this, from its porosity, having a tendency to fall off.

Chemical Action in the Storage Battery.

A storage battery, it may be said, is an apparatus of the type of the galvanic battery. There exists in it dissimilar chemical conditions, the spongy lead being opposed to the oxide, or rather peroxide, of lead. These set up galvanic action, the oxygen of the oxide attacking the pure lead, with the formation of an electric current. The result is that the peroxide (PbO_2) becomes monoxide (PbO), while the spongy lead is oxidized into a monoxide. When this is completed the chemical diversity disappears and the current ceases, but by sending an electric current through the cell the operation is reversed, peroxide and spongy lead are reproduced, and the battery is put again in shape for action.

The storage battery is specially useful for traction purposes of a kind to which the ordinary current cannot be conveniently applied, as for automobile carriages, electric boats, or cars running independently. In the latter each car is provided with a set of storage cells, placed under the seats, and replaced by others when near exhaustion. This system cannot compete in cheapness and efficiency with the trolley system, and the storage battery is now used only where the dynamo current is not available, or is utilized in storing up current which is not needed and is running to waste, preserving it for later employment. Thus in the case of wind-mills, tidal-motors, or other utilizations of the forces of nature, the power engendered, when not otherwise employed, can be used in charging storage batteries for later use, and in such ways this device may in the future become largely employed as a useful power-saver.

The Electric Railway.

One of the earliest and most important applications of the current from the dynamo was its employment for traction purposes. As early as 1880 three persons, S. D. Field, Dr. Siemens and Thomas A. Edison, applied for patents for inventions in this direction. Field was the first to file his application and obtain his patents, which covered the use of a motor in or under the car, operated from a central source of electricity. In these early conceptions it was proposed to carry the current on the rail. Several short railway lines were constructed in Europe on this principle. One laid at Lichterfelde (Berlin) in 1881, used the two rails as conductors, but not with success. The longest was that between Portrush and Bushmills, in the north of Ireland, constructed in 1883. This, six miles in length, used a third rail beside the roadbed and 17 inches above the ground, for the conductor, it being supported by insulated posts. The current was conveyed to the car-motor by steel springs, one at each end. In the Edison and Field railway, 1553 feet long, which was exhibited at the Chicago Exhibition of Railway Appliances, the third rail lay between the other two, and the current was taken from it by stiff wire-brushes pressing on each side of the rail.

There were several objections to this system, an important one being earth induction, with its resisting action upon the current; the result being that the overhead trolley system came first into use, the trolley being a small, grooved wheel running upon a wire supported by poles in the air, and conveying the current from the dynamo. The current is conducted downward by a metallic pole leading from the trolley to the car and is conveyed by insulated conductors to the motor, which is usually placed under the car and geared to the truck-axle. In a recent improvement the axle is made to serve as the shaft of the motor armature.

Central Power Houses.

Electric railways possess central power-plants, in which great dynamos and powerful engines are installed, capable of furnishing current to many miles of track and a large number of cars, the conductors being thick copper wires. In most systems the current, after passing through the motor, is carried to the rail and thence into the ground, but in some there is a "metallic circuit," two wires being employed. The motorman, by the use of the lever at his hand, can make or break the current at will, or introduce "resistance coils," so as to regulate the strength of current supplied to the motor. The varying speeds of the car, and its easy stoppage, are readily controlled.

In a number of instances the conducting wire is carried underground instead of overhead, a more costly but otherwise successful system. One of the earliest examples of this was at Budapest, Hungary. In the city of New York—not Greater New York—law forbids the use of the trolley system, and that city was confined to the horse-car railway for years after other cities were enjoying the far more expeditious and satisfactory trolley-car. The underground electric system is now being gradually introduced there, and must eventually banish the horse from this field of duty. In 1899 the Third Avenue Railway was changed from cable traction to the underground conduit electric service, and with complete success. It is expected that in a few years every street railway in the city will be equipped with this electric system.

Feeders for Over-Head Trolleys.

In the overhead trolley system separate feeding wires are carried from the central station, their purpose being to supply electricity to the main wire at successive points in the line. In cities these are carried under ground, ascend the supporting poles at intervals, and are extended from the tops of these poles to the central trolley wire. In the underground system two methods are in use. In one of these a continuous bare conductor is placed in a conduit with an open surface slot, the current being taken off by means of a traveling brush or roller, known as a plow, sled or shoe, through which the electric force reaches the motor. In the other the conducting wire is divided into sections, so arranged that each section receives the current automatically as the car passes over it. The wire is ingeniously lifted by the attraction of magnets under the car, touches short sections of conductive material in the top of the conduit, and supplies electricity through them to the motor. When the car has passed the attraction ceases, the wire falls, and the connection is broken, while the succeeding section of the conduit is brought into action.

Progress of the Electric Railway.

The general railroad system was only a few years old when the first proposition to run cars by electricity was made. In 1835 Thomas Davenport, of Brandon, Vermont, constructed an electric car, operated upon a circular track by a current obtained from galvanic cells. In 1842 Robert Davidson, of Scotland, propelled in this manner a five-ton car which ran four miles in an hour. In 1850 Professor Page, of the Smithsonian Institution, Washington, employed the current from 100 large Grove cells in operating an electric locomotive. He developed 16 horse-power and obtained a speed of 19 miles an hour on the Baltimore and Ohio Railroad. But the cost of the power confined these efforts to experiments, and the true era of the electric railway came only after the invention of the dynamo.

Mileage of Electric Railways.

Of the trolley street-railways, the earliest was established at Richmond, Virginia, in 1887, and began operations early in 1888, with twenty cars. Others quickly followed, and by the end of that year there were nearly 150 miles of track in the United States and Canada. By 1892 over 450 roads were established, with more than 3,000 miles of track and nearly 6,000 cars. In 1897 there were in the United States 15,000 miles of street-railway, of which 90 per cent. were operated by electricity. These used more than 25,000 cars, and employed a capital of about $1,500,000,000. By the end of the century nearly the entire street-railway service of the United States was operated by electricity, there being more than 1,000 railways, with a capital approaching $2,000,000,000. These were not confined to city streets, but extended like rays miles into the country, while in addition numerous rural lines existed, connecting small towns and covering very many miles of country roadway. One may travel from Paterson, N. J., to Portland, Me., by a nearly continuous line of electric rail, and from Chicago to Milwaukee, a distance of 85 miles. Still longer ones are projected. A similar system had also widely invaded Europe, and trolley cars were running in Capetown, South Africa; Sydney, Australia; Madras, India; Bangkok, Siam, and in cities in various other remote parts of the world.

The Elevated Electric Railway.

The first elevated electric railway in Europe was the Liverpool Overhead Railway, seven miles long, opened in 1893. In the same year an elevated electric road was run in the World's Fair grounds at Chicago, in which city the Metropolitan road began operation in 1895, and the Lake street elevated was operated by electricity after 1896. The elevated roads of New York, long worked by steam, began to change their motive power to electricity near the end of the century, the "third-rail" system being used there as in Chicago. Underground electric roads have also been installed, there being somewhat extensive systems in Boston and London. In the latter city, as also in New York, underground electric traction on a large scale is likely to be established in the near future.

Electric Locomotives.

The application of electric power to heavy railroad traffic has been made to some small extent, the most notable instance being in the Baltimore Belt-Line Tunnel. In this steam locomotives have been discarded, and powerful electric locomotives, operated on the overhead wire system, have taken their place, drawing heavily-laden trains daily through the tunnel. The great advantage of the use of electricity in tunnels and excavations is the escape from the serious annoyance of smoke, noxious gases, soot, and general unpleasantness. It seems probable that the electric system may in coming years displace steam on surface roads in general, the third rail being employed, with suitable precautions, to protect the public from death by contact with this apparently harmless but really very perilous stretch of loaded iron.

Electric Telpherage.

Electric carriage has been applied in other ways than those mentioned. A system known as Telpherage was devised by three English electricians, Jenkin, Ayrton, and Perry, and first applied in 1886 on a line about a mile long at Glynde, near Lewes, England. It was used to transport clay from a pit to a railway, so as to avoid cartage over fields and water. Another was erected in Cornwall to transport minerals from a mine over a difficult section of country. The system has also been used to transport logs from a forest. In telpherage the conducting wire is suspended in the air on posts or otherwise, while small electric motors run on the wire, which supplies them with power. From these motors are suspended carriages, in which the load to be moved is placed. The system has its advantages, especially if water-power is convenient to generate the current, but it has as yet been little employed. Reference should be made here also to attempts to move canal-boats by electricity. This is still in the stage of experiment.

Heating and Cooking by Electricity.

It becomes important now to consider another application of electricity, closely connected in character with the electric light, that of electric heat. It is well known that electricity develops heat in passing through even the best conductors, and that if the conductor be poor a large quantity of the electric motion is transformed into heat of the conducting substance. The temperature is greatest where there is a partial break in the circuit, as in the arc-light, whose temperature rises in the central point of action to about 6,000° F., twice the degree necessary to melt iron. When there is no break, but considerable resistence exists, much heat is also produced. This fact has been utilized in the heating of street-cars and also for cooking and general heating purposes. The heaters consist of coils of circuits of some refractory metal, the wires being of the thickness adapted to produce the greatest heating effect. The coils are placed inside metal boxes or radiators, which receive and throw off the heat. If it is desired to heat water or some other liquid, the coils or the radiating boxes are placed in the liquid, so that it may absorb all the heat evolved.

In the street-car the heater uses up a considerable portion of the energy, and cannot be largely employed without an increased power-plant. Various electric cooking utensils have been devised, though the cost of the current stands in the way of their rapid adoption. Each of these carries its own heating coil, and it is only necessary to attach the wire and turn the switch to bring it into service. Its great advantage is the ease and rapidity of action, the absence of ashes and dust, and the escape from the vexations of ordinary fuel. The only thing that prevents the general use of electricity as a means of cooking and house-heating is its cost. A sufficient reduction in this may revolutionize the system of household light and heat and introduce ease and cleanliness into the kitchen.

The Electric Furnace.

In another direction electric heat is being very usefully applied. The exceedingly high temperature produced by the voltaic arc has put into the hands of practical men a most efficient agent, enabling them to fuse refractory substances which hitherto defied their efforts. The electric furnace finds one of its applications in the extraction of metals from their ores. The crushed ore is permitted to fall through the arc, by which it is melted ; the liquid substance being received in a vessel in which the separation of the metal can be effected. In other furnaces the ore is placed between electrodes of some refractory substance and a powerful current passed through it. In the Cowles furnace, employed to reduce aluminium, melted copper forms an alloy with the aluminium as soon as separated. Among the important products of the electric furnace are carbide of calcium, the source of acetylene gas, and carborundum, or carbide of silicon, a substance not before known, but of great value from its abrasive powers.

Electric Welding.

Another important use of electric heat is in the welding of metals, which it performes with a rapidity and perfection previously unknown. In this system, as devised by Elihu Thomson, powerful currents are passed through the metals, heating them to incandescence, and they are then caused to unite by pressure or hammering. In the dynamo used for this purpose the commutator is discarded, alternating currents very well answering the purpose. All that is necessary is to bring the surfaces to be united into firm contact, and pass the current through them. As it crosses the imperfect junction the resistance to its passage causes intense heat, sufficient to soften the metal, the pieces being at the same time pressed strongly together. Usually the metals are made to touch at a single point. This first heats and welds, and new parts come into contact, until all the surface is at welding temperature. The process is remarkably rapid, a few seconds sufficing to produce union in small work and only a few minutes being needed in large work. As the heating is confined mainly to the contact parts there is no waste of energy. Large masses of metal have been joined in this way, and rails have been united in continuous sections, after being laid in position in railroad construction.

The Transformer and Alternating Currents.

In the use of powerful currents, and their division and application to special purposes, one difficulty exists, which has been overcome by the ingenious apparatus known as the Transformer. At times powerful current and low voltage, or electo-motive force, are needed; at other times currents of reduced quantity and high voltage. The change from one of these conditions to the other is effected by the transformer. This consists of an induction coil in which the primary wire is long and thin and the secondary wire short and thick. Alternating currents of small strength but considerable voltage can be sent with little loss over long wires, their high potential aiding them greatly in overcoming resistance. Thus, by aid of the transformer, they can be converted into currents of considerable strength and low voltage. In this way currents of small quantity may be economically sent over thin wires from generating stations, and there changed into currents of large quantity but reduced force by the thick wire of the transformer. A current of 10 amperes, at 2,000 volts, may be changed into one of twenty times its strength, or 200 amperes, with only one-twentieth its voltage, or 100 volts. This is technically known as a *step down transformer*. In the *step-up transformer* the action is opposite to that described. By use of the latter, Tesla succeeded in obtaining currents of very low strength but enormous voltage. A powerful current of 2,000 volts will exert on the human body the process named Electrocution, producing instant death. But Tesla has passed currents of 200,000 volts through his body without injury. In these the electro-motive force was so intense that the electricity streamed from parts of his body into the air. As already stated, a room can be illuminated in this manner, copper plates being placed in the ceiling and floor, while the glow comes from vacuum tubes anywhere between them.

Electric Blasting.

Among the applications of electric power not already mentioned is the important one of exploding gunpowder or other explosives by the electric spark, a method long employed and of great utility. Danger to operatives in blasting is greatly reduced when the old-fashioned time-fuse is replaced by long wires and the work is done by simply bringing the ends of the wires into contact. In some great operations the use of this system is indispensable. Such was the case in the blowing up of the reefs at Hell-gate, New York. Here the rock was extensively tunnelled, many ramifying passages being made, and a large number of dynamite blast charges were introduced. It was necessary for the full effect that these should be exploded simultaneously, and the only known method by which this could have been done was by the use of electricity, the whole series being connected by wire, so that the passage of the current produced simultaneous sparks in each charge. In underwater explosions, as of mines in naval warfare, electricity is similarly useful, and in this direction generally its importance is obvious.

Electrocution.

We may, in passing, allude to another recent use of the electric current, that of capital punishment with its aid. This has been the method of execution in New York State since January 1, 1889, and in Ohio since July 1, 1896. The first criminal to suffer death by this method was a murderer named Kemmler, who was executed August 6, 1890. He was fastened in a specially constructed chair, and the current passed through his body from the top of the head to the lower part of the spine, contact being made with moistened sponges. An alternating current was used, with a voltage of over 1,500. Seventeen seconds sufficed to produce apparent death, though contact was repeated for 70 seconds to make assurance absolute. In all later executions one electrode has been applied so as to cover the forehead and temples and the other placed upon the calf of the leg. In addition to these legal executions by electricity, what may be called involuntary electrocution is of somewhat frequent occurrence, through operatives and others coming into contact with heavily charged wires by accident or carelessness.

Resistance Coils.

These are coils of wire introduced into an electric circuit, and of use for various purposes, one of these, as already stated, being to produce heat, another being to locate faults in telegraph wires or cables. For this purpose the coil is arranged in sections, so contrived that new sections may be introduced at will, and the resistance successively increased or diminished. By an ingenious use of these resistance coils the locality of a fault in a cable or an underground wire can be very neatly traced, the resistance of the remaining wire closely indicating its length, a fact of inestimable advantage in prompt and economical repair.

Units of Measurement.

There are units of measurements which recent progress in electrical engineering has rendered necessary. These units have been named after the great discoverers in electrical science, a well-deserved and practical way of perpetuating their memories. Two of these we have already mentioned, the ampere and the volt. The ampere is the unit of current, the volt (shortened from Volta) that of pressure or electro-motive force, the ohm that of resistance. One ohm equals the resistance of a hundred feet of copper wire of the size of a pin, and one ampere the current which one volt of pressure will force through one ohm of wire. The coulomb is the unit of quantity of one ampere flowing for one second, and the farad (shortened from Faraday) the unit of capacity to contain one coulomb. Other units are the henry, representing the induction which a wire exerts upon itself when the current is made or broken; the joule, the unit of heat developed in passing one ampere through a resistance of one ohm; and the watt, the unit of power, it being equivalent to a volt-ampere, or the combination of current and pressure. These units of measurement are in constant employment by electricians, and are of great utility in the practice of their profession.

THE FORCES OF NATURE

Heat is of almost supreme importance in human affairs, since the employment of electric power is very largely a secondary application of the force of heat, and steam power is directly due to heat. As a preliminary, therefore, to the discussion of our special subject, a brief statement of the scientific aspects of this very useful agent of nature will be in place.

The Caloric Theory of Heat.

Heat, like other powers of nature, was long misunderstood, its true nature and origin not being generally perceived until the nineteenth century. It was previously supposed to be a subtle and imponderable form of matter, capable of penetrating all material things, and known by the name of Caloric. The entrance of this substance into our bodies was held to be the cause of warmth, its departure that of cold. Its particles were supposed to repel each other and attract those of other substances, thus causing contraction and expansion. And it was thought that compression, as when iron is condensed by heavy blows, left less room for caloric, so that it was forced out, producing external heat.

Heat as a Mode of Motion.

This theory is no longer entertained. Heat is now believed to be a motion, not a substance, and the name Caloric is becoming one of the lost words of our language. This idea, it is true, is not strictly a new one. It was advanced by Lord Bacon, several centuries ago, and later by Locke and Descartes. In 1797 Count Rumford (originally Benjamin Thompson, an American) advanced a similar theory, based upon his observations on the boring of cannon, in which the quantity of heat produced seemed out of all proportion to the small weight of metal removed. He concluded that anything which an insulated body could yield *without limitation* could not possibly be a substance, and that it must be a motion. But these views gained little attention, and the material theory of heat remained in vogue.

A few years later Sir Humphrey Davy gave the caloric theory what was practically a death-blow, by showing that heat could be generated by the friction of two pieces of ice in a freezing temperature, either in the air or in a vacuum. The ice was liquified by the friction, being converted into water, whose heat-containing powers are much greater than those of ice. If heat, then, were a substance, the water should have grown colder; and the production of heat in this instance proved that it was a result of the force of friction, and therefore motion instead of matter. This view was still disputed, but it soon became generally accepted, and in 1843 Mr, Joule, of Manchester, developed a heat-unit, by showing that one degree of heat is produced by the expenditure of 772 foot pounds of work, or that one pound of water, falling 772 feet, will have its temperature raised 1° F. by collision with the earth.

Transference of Heat.

Heat is now believed to be due to rapid vibration of the minute particles, or molecules, of matter, which dart back and forth with an energy that is capable of performing mechanical work. The sensation of warmth is the result of the flow of this motion into the flesh, causing its particles to move more rapidly, and thus affecting the nerve terminations; cold comes from the loss of this motion. The heat motion escapes from all substances in the form of radiation, and heat continues to make its way from warmer to colder substances until their speed of molecular motion is the same and equilibrium is established.

Heat of the Sun.

There are two main sources of heat, the emanations from the sun and chemical action upon the earth. Our solar orb pours forth continually an extraordinary volume of this motive force, much of it reaching us as light, or visible heat, much more as invisible heat, the rate of vibration of the latter being above or below that of light. It has been calculated that the heat received by the earth in a year would be sufficient to melt a stratum of ice surrounding the whole surface and 105 feet in thickness. But the sun actually sends out 2,300,000,000 times this amount of heat, since only a minute fraction of its total emissions reach the earth. It is calculated that the heat at its surface is sufficient to melt ice at the rate of 2,400 feet in thickness every hour, and that if it was composed of burning coal it would be reduced to ashes in 5,000 years. All the vast number of stars—except the planets—which are visible in the heavens are sending out heat and light in similarly immense volumes, though their distance is so immensely great that we receive from each of them but little light and scarcely any traceable heat.

Terrestrial Heat.

There are three general sources of heat upon the earth's surface. It is yielded by mechanical motion, when this produces friction, percussion or compression; also when motion is checked or stopped by any means. It is yielded by electricity, as in the effects of lightning, or of the flow of a current along a poor conductor. But its principal cause is chemical action, the union of chemical elements into compounds, or of compounds with one another, the usual result being an outflow of heat of greater or less intensity. A fourth source of terrestrial heat is its upflow from the heated interior of the earth, which seems to be in a greatly heated state. We gain vivid evidence of this in the ejection of molten lava from volcanoes, but the ordinary outflow of heat through the earth's crust is very slight, it being estimated to raise the temperature not more than $\frac{1}{80}$ of a degree.

Combustion.

Chemical action varies greatly in its intensity and its production of heat. In one case it may proceed in the slow manner of the gradual decay of wood or rusting of iron; in another by the rapid oxidation, or the burning, of these substances, with the emission of intense heat and light. In other instances its action is still more rapid, as in the case of the explosion of gunpowder or dynamite, in which chemical combination is practically instantaneous, great volumes of gas resulting and expanding with explosive force. This explosion is really due to heat, or the vibration of the molecules, which are set free from the force of attraction and rush outwards with all their native energy. But what we are here especially concerned with is ordinary combustion, the union of the oxygen of the air with the carbon of wood, coal, or other combustible substances, which forms our most useful source of heat.

Uses of Heat.

The application of the heat of combustion to man's uses is one of the chief means of rendering the earth habitable outside the tropical regions. By its aid the chill of winter is overcome and the food substances of the earth are rendered far more palatable. Of its other uses the most important is its employment as a power-producer, usually through the conversion of water into steam and the use of the latter in the steam engine. In this process coal is now the fuel generally used, though petroleum, natural gas, and other combustible substances are employed to some extent. It may briefly be said that water boils at the comparatively low temperature of 100° C. or 212° F., that one cubic inch of water expands into 1,700 cubic inches of steam, and that this steam exerts a powerful pressure, the conversion of one cubic inch of water into steam being equivalent to 2,125 foot-pounds of work.

The Steam Engine.

The steam engine, useful as it is to man, is of very late origin, though its principle was recognized more than 2,000 years ago. The first steam engine on record is the Eolopyle (*Æolus*, the God of the Winds; and *pila*, a ball) of Hero of Alexandria, who lived about 120 B.C. This machine consisted of a hollow globe containing water, capable of turning about a horizontal axis, and having two bent tubes with small apertures inserted in a plane perpendicular to the axis at its centre. When the globe was heated the steam escaped from the tubes, and by its reaction caused the globe to revolve. Porta (1580), De Caus (1615), and Worcester (1663), conceived independently the idea of employing the pressure of steam to raise water. Subsequently (1698) Captain Savery took out a patent for a machine on the same principle for raising water from a mine. In 1690 Papin thought of using steam to raise a piston, and in 1705 Newcomen constructed an engine worked by a piston moving in a cylinder. The steam from the boiler passed to the lower part of the cylinder and raised the piston. The steam was then cut off, and a jet of cold water sent into the cylinder so as to condense the steam contained in it. The upper part of the cylinder communicated with the air; consequently, after the condensation of the steam, the atmospheric pressure and its own weight brought down the piston. The communication with the boiler was then renewed, and the whole action repeated. In 1763 James Watt, of Glasgow, while repairing a Newcomen engine, conceived, and, by laborous study, realized improvements which constitute the chief features of the modern steam engine.

James Watt's Engine.

The improvements which have immortalized the name of Watt are the following:—

1. In order to avoid the waste of heat consequent on the alternate heating and

cooling of the cylinder, Watt introduced a condenser apart from the cylinder. When the piston reached its highest point, therefore, he opened a communication between the lower part of the cylinder and a separate chamber into which a jet of cold water was made to play, its effect being an immediate condensation of the steam.

2. Watt also introduced an air-pump into the condensing chamber to remove the heated water and air.

3. Another improvement was the *double action* on the piston. The steam was introduced above and cut off from below when the piston was required to descend, and the communication above was closed and that below opened when the piston had to ascend.

4. Watt also introduced the plan of cutting off the steam before the piston reached its limiting position, so that its momentum should be destroyed gradually, and not by a sudden percussion at the end of the stroke.

Low-Pressure Engine.

Watt's engine was what is now known as a condensing or low-pressure engine. In modern practice non-condensing or high-pressure engines, in which the steam, after moving the piston, passes directly to the atmosphere, are very generally used. The first of these, of a practical character, was invented about 1787 by Oliver Evans, of Philadelphia. It is now usual to employ steam of a higher pressure than formerly, even with condensing engines. The force of the steam from the moment the steam valve is closed is continually diminishing to the end of the stroke, and if it were cut off at a small fraction of the stroke, it might become so attenuated as not to drive up the piston. On this account, when the expansive system is used, steam of higher pressure is employed. The term high-pressure, however, has been generally applied to engines in which the exhausted steam is driven into the air. Such steam must evidently always exceed the pressure of the atmosphere.

High-Pressure Engine.

The non-condensing engine is more simple, and consists of fewer parts than that which has been described. It is generally used for locomotive engines, steam carriages, and steam vessels required to possess lightness and rapidity. Although it is more elementary and simple than the other, it was not invented until many years after the condensing engine had been brought nearly to perfection. In condensing engines the pressure of the steam in the boiler is much lower than in non-condensing, in which the boiler-pressure has been increased until pressures of 200 pounds per square inch are now common, being eight times as much as was usual about 1860.

The locomotive engine differs from the stationary engine in several important features. Such engines require to be smaller and lighter than others; hence the apparatus for condensation is rejected, and high-pressure is used. The boiler is an oblong cylinder, through which a number of tubes are arranged horizontally, in communication with the furnace and chimney. By this means a very large surface is heated in contact with the water. After moving the pistons, the steam escapes from the cylinders by two pipes meeting in a common tube or blast-pipe, which passes into the chimney. When the expedient of turning the exhausted steam into the chimney was first adopted by George Stevenson, it was found that the speed of the locomotive on which the experiment was tried had been doubled.

How Steam-Power is Measured.

The working power of a steam engine is estimated in horse-powers, one horse-power being equivalent to 33,000 foot-pounds per minute, that is, the power to raise 33,000 pounds one foot in one minute. There are three kinds of horse-power referred to in connection with engines, *nominal*, *indicated*, and *actual*.

The *nominal* horse-power is found by multiplying the area of the piston in inches by the average pressure, and multiplying this product by the number of feet the piston travels in feet per minute, then dividing this last product by 33,000. The quotient will be the nominal horse-power of the engine.

The *indicated* horse-power is found by multiplying together the mean effective pressure in the cylinder in pounds per square inch, the area of the piston in square inches, and the speed of the piston in feet per minute, and dividing the product by 33,000.

The *actual* horse-power is the indicated horse-power minus the amount expended in overcoming the friction. The following is a general rule for calculating the horse-power of an engine:

RULE.—*Multiply the area of the piston in square inches, the mean pressure of the steam on the piston per square inch, and the velocity of the piston in feet per minute, together, and divide this product by 33,000. The quotient will be the horse-power.*

In modern engines, of high initial boiler-pressure, it is growing customary to employ two or more cylinders, so as to use the entire pressure of the steam. Thus, if the initial pressure be 200 pounds and the steam be cut off at one-half, a pressure of 90 pounds can be obtained in a second engine, and if a similar cut off be used, a 40 pound pressure can be utilized in a third cylinder, about 15 pounds in a fourth and 5 pounds in a fifth. Usually, however, this process is not carried beyond the third stage, double expansion being used for locomotives and large stationary engines, and triple expansion for the large engines of ocean steamers. These are termed respectively "compound" and "triple-expansion" engines.

Modern Engines.

The power of the steam engine has steadily increased from the time of Watt till the present date, engines of greater and greater horse-power being employed, until hundreds or even thousands of horse-powers in a single engine are not uncommon. The power employed in the great ocean passenger steamers, for instance, has increased until some of these are driven through the waves with a force of more than 20,000 horse-power, and cross the ocean in less than six days. Of course, this power is divided between a number of engines. A similar power is employed in the great battle-ships and cruisers of our navy, the *Columbia*, for instance, having 18,500 and the *Minneapolis* 20,862 horse-power. In stationary engines the power employed has been similarly increased, until enormous engines are now employed for pumping, ore-grinding, and other purposes, including the running of dynamos, whose extraordinarily high speeds are rapid consumers of power.

The Steam Turbine.

Of recent years steam has been adapted to the movement of engines in a new manner and with remarkable effect. In the Chicago Exposition of 1893 was shown an early example of this apparatus, known as the De Laval Steam-turbine. This novel invention was constructed on the principle of the turbine water-wheel, though of diminutive size, and consisted of wheels having deflecting plates, which were turned by the impact of the steam. This was admitted near the centre and discharged at the periphery, driving the wheels by its escaping force, rather than by its pressure, as in the steam engine. To obtain the best results with this apparatus, the wheels are rotated at a tremenduous speed,—fifty rotations a second in a wheel of four inches diameter developing five horse-power.

The most important application of the steam-turbine, up to the present time, has been to torpedo-boats. The first example of this was the Thornycroft torpedo-boat *Turbinia*, which was fitted in 1897 with the Parsons' steam-turbine, and was driven through the water at a speed never before attained in nautical records. It has been surpassed by the *Viper*, a later ocean-flyer, which has reached the extraordinary official mean speed of 36.58 knots, with a maximum speed of 37.1 knots per hour, doubling the rapidity of motion of the battle-ship against which it is designed to be used. To attain this speed 12,300 horse-power was employed. It is still an open question whether this machine can be economically and efficiently used in larger vessels. If it should be introduced, one result of great value would be attained, which is that the boats named, even when driven at their highest speed, show a total absence of vibration. All ocean travelers can appreciate the advantage of this, as compared with the extreme vibration of the high-speed passenger steamer, and it would be of equal value in war-ships, as giving the vessel a steady gun-platform.

Superheated Water-Motor.

Still another method of applying steam for power purposes has been recently devised, the employment of water in a state of intense heat. By subjecting it to enormous pressure while heating, water may be made to take up a large quantity of heat without forming steam. This superheated water is forced, under great pressure, into a tubular reservoir under the car-floor, insulating jackets of magnesium preventing the escape of the heat. By an ingenious device the water is made to fall, drop by drop, into a high-pressure cylinder, where, having room to expand, it at once flashes into steam. As the tanks become exhausted, they can be refilled at proper intervals along the road. The saving over the ordinary steam engine is claimed to be one-half, and in a recent test a speed of forty-five miles an hour was attained.

Water-Power.

In the steam engine the power of water in its gaseous form is employed, but nature has provided liquid water under conditions capable of yielding enormous power, with no expense beyond those of apparatus and operation. This is by the utilization of the energy of falling water, which is manifested in a vast multitude of descending streams upon the earth's surface. For this power we are primarily indebted to the sun, which lifts sea-water in the form of vapor high into the air. This, discharged from the clouds as rain or snow, on hill and plain alike, makes its way back to its mother-ocean, descending in thousands of slopes, rapids, and falls, each of which possesses energy capable of being used by man.

The total volume of water-power upon the earth is, as above said, enormous. Use has been made of it for a long period of time, and it is now employed to a very large extent. It has often, however, the disadvantage of being inconveniently located, for which reason the steam engine has largely replaced the water-wheel. Steam power, while more costly, has the advantage of adapting itself to use in any desired situation.

Electric Conveyance of Water-Power.

In the later years of the nineteenth century inventions were made which went far to put an end to the disadvantage of water-power as compared with coal and steam. It became possible to convert this power into electricity, convey the latter by wire for many miles from its place of origin, and reconvert it into power, while it was equally possible to divide and distribute the single current to hundreds of motors, small and large. In this the first step was taken towards dismissing the steam engine from many of its old fields of action and replacing it by the electric motor.

The great installation at Niagara, with its 100,000 horse-power, is thus largely utilized in Buffalo, and electric power of similar origin is in use in many other localities. It seems far easier to convey electricity on a wire than to carry coal in cars and carts, and the simple motor takes up but a fraction of the space needed for coal-storage, fire-room, boiler, and engine. When the problem of carrying electricity for much longer distances, without serious leakage on the way, is solved, and the cost of the power plant and its working is sufficiently cheapened, the electric motor is likely to come very largely into use. That this will be achieved, and in no long period, is a very probable event.

Water-Wheels.

The immediate apparatus by which the power of running streams and falls is utilized is the water-wheel, in some one of its various shapes. This consists of a wheel provided with buckets or float boards on which the water exerts its energy of motion. Water-wheels usually turn in a vertical plane around a horizontal axis, and are of three kinds, undershot, overshot, and breast wheels. In undershot wheels, used when there is a large quantity but slight fall of water, float boards on the surface of the wheel are immersed in the water, and moved by it as it shoots under the wheel. Overshot wheels are used where the fall is high and the water small in quantity. Here buckets of suitable shape stud the circumference of the wheel, are filled by the falling water, and turn the wheel as their weight carries them downward. In the breast wheel both the weight and the impact of the water are utilized.

The turbine wheel, now very largely used, is a horizontal wheel with a vertical axis, the water being received and discharged in all directions around the axis. Both the weight of the water and the impact of its fall act to turn the wheel. Turbines have the advantage of being small in bulk in comparison with their power, and being applicable to high and low falls alike. In such great installations as the Niagara Falls power-plant they are the only form that can be conveniently introduced.

Tidal Motors.

The above are not the only ways in which the force of water is adapted to the use of man. In addition to the energy of falling water, there is an energy of lifting water that would far more than supply man's utmost needs, if it could be easily utilized. This is the lift of the tides, which passes twice daily around the earth. Tidal waters, indeed, rise and fall, and may be utilized in both phases. But this action ceases for a half hour or more at each turn of the tide, and for this and other reasons no successful effort has yet been made to take advantage of tidal action. If tidal motors are to be utilized there must be some way of storing up the power of the water when strong for use when weak, and the most convenient way of doing this seems to be by use of the electric storage battery. Some tidal motors have been constructed, but as yet very little use has been made of this immense, but inconvenient, supply of natural energy.

Air Motors.

Another great reservoir of power, provided by nature, is in the motion of the air, the winds, which are rarely quite at rest, though of highly variable strength. The use of wind power, through the aid of the familiar wind-mills, has been common for many centuries, these mills, with their rotating sails and internal machinery, being widely employed for such minor purposes as pumping water, sawing wood, grinding corn, and other agricultural needs. This source of power does not seem likely soon to be utilized for any more important purpose, the great irregularity of the winds in force and direction, and their frequent cessation, standing in the way of any general application.

There is reason to believe that wind-mills were brought from Asia to Europe during the Crusades, and it is certain that they were in use in Europe during the 12th century. Their employment increased until, by the opening of the 19th century, they were very widely employed. After that date the steam engine largely took their place, though they are still very familiar objects in the Netherlands and are numerous in France and the United States. In good situations and under ordinary conditions, a wind-mill can be trusted, as an average performance, to do eight hours' work out of the twenty-four. In some places they serve as an auxiliary to the steam engine, which is stopped when the wind sails begin to turn. In one such instance, at Faversham, England, a 15-horse-power wind-mill raised 21,000,000 gallons of water from a depth of 109 feet in ten months, saving the consumption of 100 tons of coal.

In former times the dome of the wind-tower had to be turned by hand to meet every shift of the wind, but about the year 1750, Andrew Meikle devised an appliance for moving the sails automatically so as to face every wind. Formerly a wind-mill sail was covered with a sheet of canvas, which could be fully spread or partly furled as the wind varied in strength. At present various other methods for "reefing the sails" are in use. Many other improvements in wind-mills have been made, and the light and graceful forms now seen in our rural landscapes are much more effective and easily managed than those formerly employed. But the variable character of the wind has hitherto forbidden its employment for any purpose where a steady and continuous power is needed. Lord Kelvin has advocated its use for charging electrical storage batteries; and this, in view of the vast amount of power going to waste in the winds, may in the future be widely adopted.

Hot-Air Engines.

Another application of the atmosphere as a motive power is in the form of heated air, which there have been many efforts to apply in the same way as steam. Inventions in this direction were made early in the 19th century; the first air engine which had any success being made by the Rev. Dr. Stirling, a Scotchman, in 1816. This was improved in 1827, and again in 1840, and various other inventions were made, several in France, and a half dozen or more in the United States. Of these the most generally in use is that produced by Ericsson.

The chief advantage of the hot-air engine is that it needs no boiler, thus avoiding the weight and the danger of this appendage of the steam engine. Air engines also are much the cheaper and need less skill and attention. But, on the other hand, the pressure of hot air is much less than that of steam, so that a considerably larger cylinder and piston are necessary. There are two classes of air engines, one drawing its supply directly from the atmosphere, heating it, and discharging it after use again into the atmosphere; the other employing a fixed supply of air, which is heated and cooled alternately. The Ericsson engine, the form most in favor in the United States, adopts the first of these methods. Belon's engine, a French invention, is the only one that has been used on a large scale in an important industry, this being an extensive paper manufactory at Cusset, France. This machine also uses air drawn directly from the atmosphere. Though of 120 indicated horse-power, only about 30 is actually utilized, the remainder being consumed in gathering the supply and overcoming the resistance, while there is a large loss of heat, the air escaping into the chimney being at a temperature of 450° F.

Compressed Air Motors.

The power of the air has recently been applied in a different form and with very useful results. In this method the air is condensed by pressure into a small fraction of its original volume, and then set free to exert its force upon machinery. Some of the first important uses of this powerful and convenient agent were in excavating the tunnels in the Swiss mountains and in the Hoosac Mountain, Massachusetts. At Mont Cenis, Italy, the air was compressed by the power of descending streams on the mountain side and conveyed by pipes into the tunnel. At Hoosac Mountain the air was compressed by steam power. The compressed air was used in working the rock drills in the tunnel, the ease with which the pipes conveying it could be moved from point to point and carried to greater depths rendering it very serviceable.

Despite the evident advantages of compressed air as a motive power, there have been certain difficulties which stood in the way of its general use. One of the first inventions to overcome these difficulties was the Beaumont engine, of English origin. This utilizes the entire power of the air, no matter how high the pressure may be. The air is admitted from the compressors into successive cylinders, the smallest being used first, so that, as the pressure falls, the volume of air increases, and the force is thus kept uniform. American inventors have of late years been busy in this field, and with very considerable success, particularly in the application of compressed air to the moving of street cars. Cars equipped with compressed-air motors were tried in 1896 and 1897 on some of the lines in New York city, and similar cars are in use in France, Switzerland, and elsewhere in Europe, as also on some American roads. Motors of this kind seem destined to come far more widely into use. Another utilization of compressed air is in the working of pneumatic tubes in the post-office service, letters being driven by its aid from the central to the branch offices in large cities.

Uses for Compressed Air Motor.

The uses to which compressed air is now applied are quite numerous, and only a few, in addition to those named, can be spoken of here. It is employed very effectively in drilling, stone surfacing, riveting, and for various other purposes in which a rapid and strong blow, easily moved or rotated, and varied in strength, is demanded. Power rammers, for heavy work in foundries, are of recent introduction, and are being rapidly adopted in Europe and the United States. One of these machines, operated by one man, can do the work of from eight to twelve men. The rammers use air at a pressure of about 80 pounds per square inch, and strike from 250 to 300 blows per minute, the air supply being strictly under the control of the operator, who can make the blow heavy or light at will. A recently exhibited use was the chipping of toughened steel by a pneumatic hammer, the chisel, driven by air at 80 pounds pressure, conveyed in a flexible tube, cutting off thick slices of the steel at the rate of one foot in a minute. For such purposes as street-car motors the air is used at pressures much lighter than the above.

The Air Brake.

One of the most important uses of compressed air is in the air brake on railroad cars, which is coming universally into use. The pneumatic or dynamite gun is another invention, which was used with some effect at Santiago in 1898. The rubber tire of the bicycle wheel owes its elasticity to compressed air, and air cushions for invalids have been for many years in use. Cellulose silk is made by driving wood pulp by air pressure through minute holes in a metal plate. Compressed air is used in a hose for the dusting of railroad cars and shops. It is employed in machine shops for operating cranes, hoists, and tools. In short, its present and possible uses are so numerous that we cannot venture farther in naming them.

Liquid Air.

The liquefaction of air offers a new and remarkable source of power. Its rapid and great expansion when vaporized would render it extremely suitable for this purpose but for certain disqualifying circumstances. The principal of these is its active tendency to return spontaneously to the gaseous state, the result being that a steady waste cannot be avoided. These difficulties seem to stand in the way of its economical utilization as compared with steam or other usual sources of power. In the proposal to use it as an explosive in blasting the same difficulties exist, and the hopes of those who are seeking to employ it as an effective power-agent do not seem likely to be realized under present conditions.

Gas Engines.

There is a class of engines of small power in which coal gas mixed with air and ignited is used as a motor. Several varieties of these are in common use, much alike in principle, the construction being usually the same as in a horizontal steam engine, except in the parts that convey the gas. This is led first to a mixing chamber, where it takes up the proper proportion of air. The explosive mixture thus made is admitted in successive small quantities within the cylinder and there ignited, the gas resulting from its explosion exerting a pressure upon the piston. In some engines, of which the Lenoir is a type, an electric spark ignites the gas at the proper moment. In others, as the Hugon engine, the ignition is performed by gas jets. These are extinguished by the explosion, but are quickly relit by an ingenious arrangement. Some of the more recent of these engines work with gas under compression. Such engines have been greatly reduced in cost of operation, and can be run at an expense of two cents per hour per horse-power. This is not as cheap as steam, but the gas engine presents advantages of compactness, ease of management, etc., which render it desirable for certain purposes, such as the propulsion of automobiles or motor carriages. In the oil engine petroleum is used as a fuel on the same principle, it being vaporized and the gas exploded along with air. Gasoline, a highly volatile liquid distilled from petroleum, is now commonly employed in this manner in automobiles, in which service it competes favorably with steam and electricity.

The Solar Motor.

We have not exhausted in the above all the natural sources of power. In truth, the basic form of all of them remains to be considered, the vast streams of solar light and heat which pour upon the earth, and to which we owe the fuel that yields us steam-power and the rain which is the source of our water-power. If the motive-power in the solar rays could be directly and easily utilized, all other sources of mechanical energy might be safely abandoned, but the attempts to make use of the heat of the sun in this direction have hitherto not been very successful. In the solar engines, of which a number have been invented, concave mirrors or reflectors are used to concentrate the rays upon a water-boiler, or in some other way to make use of the great heat thus obtainable. Among the workers in this direction, one of the most active and persistent was the celebrated engineer, John Ericsson, who devoted years to the effort to produce a solar engine suitable for use on the sunlit plains of southern California. He died before his experiments were completed, but others have taken them up, and a solar motor of much efficiency has been recently invented and is at present in operation at South Pasadena, California. This device consists of a concave reflector 34 feet in outer diameter and 15 feet in inner, it being zone-shaped like a lamp-shade. Its inner surface is covered with small mirrors, 1788 in all, each about 31½ by 24 inches, they being so arranged as to reflect the sun's rays to the focal point of the mirror. At this point is suspended a boiler 13½ feet long and with capacity for 100 gallons of water and a steam capacity of 8 cubic feet. The steam is carried by tubes to an engine, and after condensation is returned to the boiler. The reflector is turned towards the sun, and is moved by clock-work, so as to face the solar orb all day long. The heat at the focal point is intense, and so far yields ten-horse power of steam, though fifteen is claimed for it. It is engaged in pumping water for the irrigation of arid lands, and is capable of lifting 1,400 gallons per minute. The inventors are experimenting with the purpose of storing electricity during the day so as to run the engine at night and in cloudy weather, also with the idea of adding to the efficiency of the engine. This invention is a very hopeful one, as it taps a source of power which is absolutely costless, and is illimitable in quantity.

WIND AND WEATHER.

It seems to us a remarkable circumstance that animals are able to live and thrive at the bottom of the ocean, at a depth of several miles beneath the surface. Yet it is well to consider that we ourselves are dwelling at the bottom of a much deeper ocean, an ocean of air, probably not less than five hundred miles in depth, one hundred times that of the ocean of water. This atmospheric ocean has certain important peculiarities. While the oceanic water currents reach to no great depth and storm-waves are confined to the surface, the currents of the aerial ocean reach to its lowest depths, and its storm-waves sweep the surface of the earth. This fact is of very great importance to us, for without it the land surface would be a very undesirable place of habitation, if, indeed, any of the higher forms of life could exist in a sluggish or torpid atmosphere.

These air currents or winds are due to a variety of causes. The atmosphere, while composed of about 70 per cent. of nitrogen and 30 per cent. of oxygen, with a minute proportion of carbonic acid gas, also holds a variable quantity of water vapor, the latter being one of the most effective agents in causing the movements of the air known as winds and storms. The tendency of this vapor to rise when heated, and carry the air with it, is a prolific source of air movements, the surrounding air flowing freely in to fill the partial vacuum. If the latter is strongly marked or covers a wide area, the resulting movement of the air will be decided, and may be felt for many miles from the centre of influence. The other winds of the lower atmosphere are very largely due to variation of temperature, arising from difference of latitude, propinquity of land and ocean areas, and other causes.

Trade-Winds.

Winds are usually classed in three divisions, permanent, periodical, and variable. The first of these—air currents which move steadily in fixed directions the year round—

are known as Trade-Winds, their cause being the constant upflow of heated air in the tropics and the equally constant inflow of air from the temperate zones to fill the rarefied air space. If the earth were at rest these winds would move directly southward in the northern hemisphere and northward in the southern, but the daily rotation of the globe changes their direction. This rotation causes any point on the equator to move at the rate of about 1,000 miles an hour, or 17 miles a minute, while points on the pole simply turn without changing place. Points between the poles and the equator move with intermediate speed, the speed at 60° latitude being about 8½ miles. Thus, as the winds blow towards the equator, they constantly enter regions of more rapid motion, and the moving air lags behind, seeming to come from the east. This is due to the fact that the earth turns eastwardly, so the trades form north-easterly winds in the northern hemisphere and south-easterly winds in the southern. The north and south trades do not meet, there being an equatorial region of calms four or five degrees wide between them. This region is the seat of frequent thunder-storms and violent downpours of rain. The declination of the sun to north or south as the season advances causes a variation in the position of the trade-winds, and from this cause in some localities they become periodical, blowing one half the year in one direction and the other half in the opposite direction. These winds, blowing over the Indian Ocean and Southeastern Asia, are called Monsoons.

Anti-trade and Periodical Winds.

While the heated air ascends in the tropics, and the colder air rushes in to take its place, the ascending air, in its turn, flows towards the poles in the upper atmosphere, forming what are known as the anti-trade winds. These slowly descend, reaching the surface in about 25° to 35° of latitude, where they take the place of the lower air that is drawn by the trades towards the equator. Here they form westerly winds, their direction being opposite to that of the trades.

Periodical winds are usually due to the counter influence of temperature over land and sea, producing the air movements known as land and sea breezes.

The origin and nature of these are easily explained. The temperature of the sea varies much less during the day than the temperature of the land. Thus, during the heat of the day the sea is cooler than the land; at night the sea is warmer than the land. Hence, in the day time, the air flows in from the sea to supply the place of the air which rises from above the heated land, while at night the heavier air over the cooled land flows towards the sea. When the land is hottest the sea breeze flows with the greatest force, and the land breeze gains its greatest strength during the coldest part of the night.

Variable winds are due to numerous local causes, such as the general configuration of the surface, the counter influences of hills, plains, and valleys, the increase of moisture over lakes and streams, the development of fogs and clouds, and the fall of rain and snow, all of which seem to affect the volume of the atmosphere in local regions and to cause movements of the adjoining air. We need scarcely say that rain and snow are the more or less immediate results of the distribution of moist air by the winds, and of the variation in density caused by the meeting of currents of air of different temperatures.

The Cyclone or Storm Wind.

The above are the more ordinary conditions of atmospheric disturbance, but occasionally special and much more vigorous causes operate, producing those violent movements of the air known as storms, or more distinctively as cyclones and tornadoes. Other names that have been given them are hurricanes, typhoons, etc. The cyclone is a vast circular storm, seldom less than 600 miles in diameter and occasionally extending over a width of more than 3,000 miles, and is marked by winds which are often of destructive violence as the centre of the disturbance is approached. It usually is the result of a rarefaction of the atmosphere extreme in intensity or widespread in area.

Commencing with an inrush of air from all sides towards a central region of rarefaction, it is easily seen that a rotary motion must needs be communicated to the resulting atmospheric disturbance. For, if we consider a definite region in the northern hemisphere towards which air is rushing from all sides, we see that the air coming from the north would be deflected towards the west before reaching the centre of disturbance, while the air coming from the south would be deflected towards the east. And all the air-currents with northing would exhibit a westerly displacement of greater or less extent, while all the air currents with southing would exhibit an easterly deflection. Thus the region of air would be moved by westerly forces in its northern half, and by easterly forces in its southern half, and so would exhibit a rotation opposite to that of the hands of a watch placed face upwards on a map of the region. Throughout the progress of a hurricane in northern latitudes, this form of rotation is exhibited. On the other hand, in southern latitudes the rotation is in the reverse direction.

Origin and Paths of Cyclones.

Cyclones exhibit a motion of translation, sometimes very rapid, which carries them from the equator first westwards, and afterwards eastwards, along paths corresponding closely with the course of the principal oceanic currents. Those which visit the United States have two general localities of origin. The greater number of them arise in the great plains west of the Mississippi River, and move northeastwardly, frequently following the line of the Great Lakes and passing out to sea by way of the Gulf of St. Lawrence. Less frequent, but much more violent, are those of tropical origin, arising in or eastward of the region of the West Indies, and entering the States from this region or that of the Gulf of Mexico. Sometimes their journey north takes place far out to sea, causing the well-known hurricanes of the Atlantic. Others follow the coast, and occasionally with a very disastrous effect. Still others take an inland course, one of the most violent on record of the latter being that which visited Galveston in the autumn of 1900 and almost swept that flourishing city from the face of the earth.

The circular or spiral whirl of the winds in a cyclone may be readily observed. The centre of the storm is sometimes nearly stationary, at others moves with varying speed, of from 10 to 50, or, in extreme cases, 70 miles an hour. As the storm approaches, moving north, if we are in or near its central line of passage, winds setting westerly will first be felt. These increase in violence as the centre draws near, and are usually attended by heavy rains. When the centre comes over us the winds fall; a temporary lull succeeds; the clouds are apt to break and the sun to appear. But as the storm moves onward the rains begin again, while the winds set to the east, at first blowing violently, but gradually declining in force as the storm passes farther to the north. The cyclone is frequently attended with hail or thunder storms, and one of its characteristic features in the West is the terrible tornado.

The Anti-Cyclone.

Opposite in origin and character to the cyclone is the anti-cyclone. As the cyclone is due to an upflow of warm, humid air, and is marked by a considerable, sometimes an extreme, fall of the barometer, the anti-cyclone is due to a downflow of dry cold air, increasing the surface pressure and causing the mercury to rise in the barometer. The winds resulting are opposite in character to those of the cyclone, flowing outward from a centre of condensed air instead of inward to a centre of rarified air. The attendant weather is dry, clear, and cold, the cold wave being one of its ordinary results. The force of the winds is never so great as in the case of the cyclone. There is probably a close connection between these two forms of storm. As we have seen, there is an uprush of air in the cyclonic centre. This, on reaching the upper atmosphere, spreads horizontally outward, and may cause increased pressure in some distant region. The result will be a condensation and overweighting of the upper air, which in consequence sinks downward, cold and dry, from its elevated place of origin, and subsequently flows outward in all directions as the dry anti-cyclone.

The Tornado.

There is another and the most violent of all storms still to be considered, the one known by the name of tornado in the United States, of typhoon in the Eastern seas, and elsewhere as the whirlwind, the sand-storm, the water-spout, and by other names. The tornado seems to be a secondary and local result of the cyclone, the outcome of some special and extreme disturbance of the air currents. In the cyclone the winds move mainly in a horizontal direction, and cover an extensive area. In the tornado the air movement is mainly vertical and the area covered very small. It is a gyration or spiral whirl upwards, into which the air is drawn with extraordinary violence. The tornado forms the extreme development of the air whirl, which may be traced downward through a series of less violent gyrations to the little dust whirl which is so common an incident in our streets in windy weather. Various theories to account for it have been offered, but it is probably the result of the meeting of two opposite currents of air, whose checked motion is converted into a spiral whirl. The traveling motion of the tornado may be due to the meeting of the fronts of two winds at an angle, so that the point of contact travels rapidly along the front.

Tornadoes are more frequent and violent in the United States than elsewhere, their special location being the great plain of the valley of the Mississippi, where severe examples often occur, causing great loss in life and property. They appear to originate in the clouds not far above the earth, and present the appearance of vast cloud funnels, with narrow flexible ends that descend to the surface, destroying everything in their path. Fortunately their track is very narrow, less than a quarter-mile wide on an average, while the bottom of the dangling, whip-like cloud occasionally lifts and leaves broad spaces unharmed. The greatest violence is in the centre of the whirl, in which everything touched is destroyed; houses being unroofed, lifted bodily, or torn to pieces and their fragments thrown long distances; great trees torn from the ground or twisted off like reeds; such weights as locomotives lifted bodily and hurled aside, and enormous power displayed in other directions. The wind pressure of a tornado has been estimated from its effects to vary from 18 to 112 pounds to the square foot and the wind sometimes to attain the enormous velocity of 2,000 miles an hour. The time of passage of a tornado over any spot is less than a minute, sometimes only a few seconds, it striking like a gigantic hammer which instantly destroys whatever it touches. Its whirling motion is clearly indicated in the twisting of trees and the turning round of houses which have been lifted from their foundations. In the United States several thousand persons have been killed by these storms and the loss of property has reached scores of millions of dollars. The most remarkable series of tornadoes on record was that of February 9, 1884, when more than 60 occurred between the Mississippi and the Appalachian Mountains, there being in all more than 10,000 buildings destroyed, 800 persons killed, and 2,500 wounded.

Aerial Vapor and Rain.

The movements of the winds of which we have spoken produce a result of high importance in the wide distribution of the vapor of water, which the heat of the sun is constantly raising from the surface of the seas. This is carried by the winds widely over the land surface of the earth, condenses in the air into clouds at various altitudes, from the fog that rests upon the surface to the feathery cirrus that floats at a height of many miles, and falls as rain or snow from the dense, dark nimbus, or rain-cloud. The humidity of the air in any region, and its consequent degree of rainfall, are governed by the direction and force of the prevailing winds and the configuration of the surface. The winds which bring strong rains are those which have blown over a broad reach of ocean. Those whose path is over the land, like the northwest winter winds of the eastern United States, bring sunshine and dry air in their track. Mountain ranges which the vapor-bearing winds must cross are great rain-producers, their effect being to cause condensation of vapor and rainfall. Thus the greatest rainfalls are those which come from winds which have crossed a broad ocean area, and afterwards blow up against and over a high mountain ridge lying in their path; especially if they pass from warmer into colder regions—since cold condenses the moisture of warm winds into clouds and rain. Beyond the mountains the rainfall grows less, the air having been robbed of much of its moisture, and where the various causes leading to a diminution of the rainfall reach their extreme phase, deserts appear, the clouds failing to yield the water necessary to support animal or vegetable life.

Regions of Great Rainfall.

The heaviest annual rainfall on the globe is due to the southwest monsoon, as it carries the vapor gathered from the tropical Indian Ocean over the peninsulas of southern Asia. At points in India the rainfall is enormous, reaching at Banca 251 inches, and at Mahabalishwar 263 inches of annual depth. It is also great in Burma, varying in different localities from 100 to over 200 inches annually. In desert regions, on the contrary, the rainfall almost disappears. At San Diego, on the seaboard of Lower California, the annual fall is only 10 inches, while inland it grows less, and the interior basin of Arizona, Nevada, and Southern Utah is a desert in almost as full a sense as the Sahara, its rainfall ranging from 3 to 17 inches annually. For short periods, the heaviest rainfalls are those which occur with thunderstorms and tornadoes, or in the famous "cloud burst," when the rain falls for short intervals at the rate of 5 or 6 inches or more per hour. In the United States a day's rainfall of from 5 to 7 inches has been repeatedly recorded, and as high a fall as 13 inches has been reached. These amounts have been greatly exceeded in tropical latitudes. At Bombay 24 inches have fallen in one night, and on Khasi Hills, India, on one occasion, 30 inches fell on each of five successive days.

Temperature and Atmospheric Pressure.

All the influences above named have their direct effect upon the weather at any locality, while another of its important characteristics is that of temperature, which varies greatly in different localities, its changes being due not alone to latitude and the varying power of solar heat, but to elevation, to the direction of the winds, to the influence of such heated ocean currents as the Gulf Stream, and to various other causes. The mean temperature of the northern hemisphere is given by Dove at 60° F., and of the southern at 56°, while the extremes for the globe, taking the annual means, are 80° F. and zero. If we take the monthly mean averages, the extremes on record are 110° F. for parts of India, and the very low mean of —61.2° F. for Verkhayausk, Siberia. The latter place has given the lowest reading of the thermometer on record, —88.8° F. The highest readings are questionable; 125° F. is not uncommon, and various higher readings have been made, but under somewhat doubtful conditions.

The Use of the Barometer.

As regards the pressure of the atmosphere, it varies daily for every locality, the height of the mercury in the barometer moving through a range of about four inches. These changes in barometric readings are very significant indications of coming changes in the weather, and the barometer is in constant use by weather observers as perhaps their most important instrument of observation. The usual range of height in the barometer is confined within an inch or two, but it becomes much greater during marked weather changes. The lowest, sea-level, marking yet observed was 27·333 inches, at Ochtertyre, Scotland, and the highest 31.360 at Barnavl, Siberia, but such extremes as these are of rare occurrence. The usual mean height is a little below 30 inches. It should be said, further, that the height of the mercury in the barometer decreases steadily as higher elevations are reached, so that this instrument is of great utility in determining height of mountains.

The ordinary use of the barometer is as a "weather glass." Generally speaking, a falling barometer indicates rain; a rising barometer, fair weather; a steady barometer, a continuance of the prevailing weather. When the mercury is low the weather is generally broken or stormy; when high, it is fair. A sudden fall indicates a storm, whose violence is in proportion to the degree of fall. An unsteady barometer indicates unsettled weather, while gradual changes point to some fixed weather condition, whether foul or fair. The causes of these changes are not very well understood, though it may be said that, as moist air is lighter than dry air, the barometer will read low whenever drier air is replaced by humidity. Warm air is also lighter than cold air, and the barometer must change when these replace each other. The upflow of air in or near a storm centre, causing a rarefaction and decrease of weight, is naturally attended by a barometric fall, while the downflow and condensation in the anticyclone centre has the opposite effect of a barometric rise. Elaborate codes of rules have been drawn up to serve as a key to the fluctuations of the barometer, but as these are not greatly to be depended upon, there is no occasion to give them here.

Weather Observations.

Systematic observations of weather changes have been made by individuals for many years, both in Europe and the United States, and numerous records of their results are in existence. Of recent years the United States has taken the lead in weather observation. Benjamin Franklin was one of the earliest to observe the movement of storms, and Thomas Jefferson made arrangements for systematic observations at several points in Virginia. It remained for Joseph Henry, after the founding of the Smithsonian Institution, to organize a system of simultaneous observations over the whole United States, and these were continued for more than forty years, yielding a large amount of tabulated information concerning American meteorology, of which several volumes have been published. These form the basis of the science of the weather in the United States, and have been of the utmost service to later observers. The invention of the telegraph proved of the greatest aid in the daily gathering of these widely scattered facts, and Professor Henry began after 1850 to display daily upon a map, by moveable symbols, the state of the weather at various points in the United States. This proved of much interest, but it was brought to an end by the Civil War.

The systematic observations of Henry, Maury, and others antedated any similar systematic work in Europe, and gave the suggestion to England and France to institute systems of weather service under government auspices. In 1861 Fitzroy started the English system of weather forecasts, and Leverrier, at Paris, began to issue the French weather maps in 1863. Other countries instituted similar systems at later dates. In 1869 the intermitted work of Professor Henry was taken up by Cleveland Abbe, director of the Cincinnati Observatory, his data being collected by the Western Union Telegraph Company, free of charge, while the maps were drawn by Professor Abbe in the telegraph office, and locally distributed. His work excited so much interest that an Act of Congress was passed in 1870, requiring the War Department to undertake a similar work for the whole country. This duty was intrusted to the chief signal officer of the army, General A. J. Myer, who at once called Professor Abbe to his assistance, rapidly organized his work, and began to issue weather bulletins and storm warnings in November, 1870.

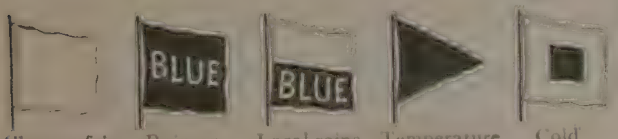
General Myer issued his daily bulletins as probable weather conditions, and soon became known as "Old Probabilities," but they were marked by so great a percentage of correctness that much confidence was placed in them. He died in 1880 and was succeeded by General W. B. Hazen, who superintended the service for seven years. His successor was General A. W. Greeley, of Arctic exploration fame. In 1891 the weather service was transferred from the War to the Agricultural Department, in which it was made a Weather Bureau under the charge of Professor Mark W. Harrington, who was succeeded in 1895 by Willis L. Moore. The forecasts of the Bureau have so improved with time that they are widely relied upon, nine out of ten proving true. There are considerably over a hundred telegraph stations in the United States, thirty stations of exchange with other countries, and State services in nearly every

State in the Union, with reports from over 2,500 voluntary reporters. More than 200 stations report floods and other river data, 1,700 stations show weather and temperature signals, while about 200 stations display storm signals, and 500 show frost signals. Forecasts are made and weather-maps published in over 100 stations, the total number of weather-maps issued annually being about 2,500,000. The Canadian Weather Service co-operates freely with that of the United States, to the benefit of both, and it is being extended to Cuba and Porto Rico, so as to cover as wide an area of the earth's surface as can conveniently be controlled.

Twice each day, morning and evening, the observers note simultaneously the weather conditions at their stations, such as temperature, barometric reading, humidity, force and direction of the wind, cloudiness, etc., telegraphing the results in cipher to Washington. These daily results are carefully studied at each station, with aid from Washington, and the probabilities of the weather for the succeeding 24 or 36 hours are publicly announced, the forecasts being widely disseminated by the newspapers and otherwise. The weather-map is daily posted in thousands of places soon after it is printed, and in the country and on the coast signals are displayed for the benefit of farmers at a distance or of ships within sight of land.

Weather Signals.

No. 1 White Flag	No. 2 Blue Flag	No. 3 White and Blue Flag	No. 4 Black Triangular Flag	No. 5 White Flag with black square in centre



Clear or fair weather	Rain or snow	Local rains or snow	Temperature signal	Cold wave

On March 1, 1887, a new system of weather signals was introduced by the United States Signal Office of the War Department. This is still in use, with such additions as experience has dictated. These signals are given by flags or steam-whistles, the flags being five in number, and of the form given above.

When number 4 is placed above number 1, 2, or 3, it indicates warmer; when below, colder; when not displayed, the temperature is expected to remain about stationary. During the late Spring and early Fall the cold-wave flag is also used as a frost-warning flag to indicate anticipated frosts.

When displayed on poles, the signals should be arranged to read downward; when displayed from horizontal supports, a small streamer should be attached to indicate the point from which the signals are to be read.

Whistle Signals.

The warning signal, to attract attention, will be a long blast of from fifteen to twenty seconds' duration. After the warning signal has been sounded, long blasts (of from four to six seconds' duration) refer to weather, and short blasts (of from one to three seconds duration) refer to temperature; those for weather to be sounded first.

Blasts.	Indicate.
One long	Fair weather.
Two long	Rain or snow.
Three long	Local rain or snow.
One short	Lower temperature.
Two short	Higher temperature.
Three short	Cold wave.

By repeating each combination a few times, with an interval of ten seconds between, possibilities of error in reading the signals will be avoided, such as may arise from variable winds or failure to hear the warning signal.

In addition to the signals indicating ordinary weather changes, there is a series of signals specially adapted for storms, giving information regarding the winds and other particulars.

Storm Signals.

A red flag with a black centre indicates that a storm of marked violence is expected.

The pennants displayed with the flags indicate the direction of the wind; red, easterly (from northeast to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light above a red light westerly winds.

Information Signal.

Red or white pennant displayed alone. When displayed at stations on the Great Lakes this indicates that winds are expected which may prove dangerous to tows and smaller classes of vessels, the red pennant indicating easterly and the white pennant westerly winds.

When displayed at stations on the Atlantic, Pacific and Gulf coasts it indicates that the local observer has received information from the Central Office of a storm covering a limited area, dangerous only for vessels about to sail to certain points, and serves as a notification to shipmasters that information will be given them upon application to the local observer. Only the red pennant is displayed on the coasts. No night information or hurricane signals are displayed.

Hurricane Signal.

Two red flags with black centres, displayed one above the other, indicate the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the Lakes and Northern Atlantic coast.

In this connection the following table may be of interest:

STANDARD TABLE SHOWING VELOCITY AND FORCE OF WINDS.

DESCRIPTION	Miles per Hour	Feet per Minute	Feet per Second	Force in Lbs. per Square Foot
Perceptible . . .	1	88	1.47	.005
Just Perceptible .	2	176	2.93	.020
	3	264	4.4	.044
Gentle Breeze . .	4	352	5.87	.079
	5	440	7.33	.123
Pleasant Breeze .	10	880	14.67	.492
	15	1,320	22.0	1.107
Brisk Gale	20	1,760	29.3	1.968
	25	2,200	36.6	3.075
High Wind . . .	30	2,640	44.0	4.428
	35	3,080	51.3	6.027
Very High Wind	40	3,520	58.6	7.872
	45	3,960	66.0	9.963
Storm	50	4,400	73.3	12.300
Great Storm . . .	60	5,280	88.0	17.712
	70	6,160	102.7	24.108
Hurricane	80	7,040	117.3	31.488
	100	8,800	146.6	49.200

The average hourly velocity of winds in the United States varies, for different points, from 5 to 11 miles per hour. The highest velocity on record for a period of five minutes was 96 miles per hour, at Denver, Colorado, and North Platte, Nebraska. The velocity during the 1900 storm at Galveston, Texas, may have surpassed this, but the wrecking of the instruments prevented its full force being observed.

In addition to the general rules for foretelling the weather from the readings of the barometer already given, the following more detailed rules, adopted for use with the aneroid barometer, but applicable to the mercury barometer, may be of service:

A Rising Barometer.

A rapid rise indicates unsettled weather.

A gradual rise indicates settled weather.

A rise with dry air and cold increasing in Summer indicates wind from the northward; and if rain has fallen, better weather may be expected.

A rise with moist air and low temperature indicates wind and rain from the northward.

A rise with southerly winds indicates fine weather.

A Steady Barometer.

With dry air and seasonable temperature this indicates a continuance of very fine weather.

A Falling Barometer.

A rapid fall indicates stormy weather.

A rapid fall with westerly wind indicates stormy weather from the northward.

A fall with a northerly wind indicates storm, with rain and hail in Summer, and snow in Winter.

A fall with increased moisture in the air, and heat increasing, indicates wind and rain from the southward.

A fall with dry air and cold increasing in Winter indicates snow.

A fall after very calm and warm weather indicates rain with squally weather.

The barometer rises for northerly winds, including from northwest by north to the eastward for dry, or less wet weather, for less wind, or for more than one of these changes, except on a few occasions, when rain, hail, or snow comes from the northward with strong wind.

The barometer falls for southerly wind, including from southeast by south to the westward, for wet weather, for stronger wind, or for more than one of these changes, except on a few occasions, when moderate wind, with rain or snow, comes from the northward.

BOOK V.

EVERY-DAY ETIQUETTE AND LETTER WRITER

THE LATEST AND MOST SENSIBLE STATEMENT OF THE RULES GOVERNING SOCIAL INTERCOURSE—THE ETIQUETTE OF CONVERSATION OF PARTIES, OF VISITING, OF RECEIVING, OF WEDDINGS, OF FUNERALS, OF ALL PRIVATE AND PUBLIC OCCASIONS, AND OF LETTER-WRITING OF ALL KINDS.

WHAT TO DO, WHAT TO WEAR, WHAT TO SAY, WHAT TO WRITE

Every Day Courtesy

It is no exaggeration to say that one can travel farther and progress faster with the passport of polite behavior than with any other ticket of equal cost. Everyone has a smile and a helping hand for the person who comes with courtesy, while the rude and boorish fellow, though his mistakes be those of ignorance, offends and makes enemies even of those whom he wishes to make friends. The finest courtesy is inborn, but its practice is so much governed by custom and rule that it is easy for anyone to learn and use in every day life.

BOOK OF ETIQUETTE

WHAT TO DO—WHAT TO WEAR—WHAT TO SAY—WHAT TO WRITE—THE CORRECT THING AT HOME—AT PARTIES—AT WEDDINGS—AT ALL PUBLIC AND PRIVATE FUNCTIONS

GENERAL PRINCIPLES OF GOOD MANNERS

Good manners stand next to a good heart in adapting men and women to the community in which they live. Indeed, so far as the opinion of ordinary society rules, they go further, for however gifted by nature or education one may be, or however well-intentioned and virtuous in conduct, if he is ignorant of the customs and requirements of good society, is awkward or ungraceful in manner, careless in speech, and heedless of social demands, and even of the arbitrary dictates of fashion, he risks exposing himself to ridicule, and may be neglected or contemned, while men far below him in character and ability, but with superior knowledge of correct social deportment, may become the admired favorites of the world. In short, it may be said that success in life often depends far more on appearance and deportment than on innate character.

According to Swift, good manners are the art of making those people with whom we converse feel at ease. This is doubtless true so far as conversation is concerned. Persons of generous impulses naturally seek to render themselves agreeable to those into whose company they come, and are no more eager to gain enjoyment for themselves than to bestow pleasure upon others. The art of pleasing is, in truth, a simple one, but frequently its cultivation is too much neglected. Many persons become so solicitous for the promotion of their own pleasure as to forget that their neighbors have claims upon them. Yet every man who enters society should bear in mind that, in a sense, he ceases to be an individual, and becomes part of an association, a social organism, as it has been called; met together, not for any one's personal gratification, but for the pleasure of the whole company.

The first requisite in our intercourse with the world, and the chief in giving pleasure to our associates, is sincerity of heart, a quality which lends the same ornament to character which modesty does to manners. A second important element of social behavior is lack of self-assertion, a modesty of manner, native or acquired, which is in no sense inconsistent with firmness and dignity of character. The well-bred man feels at ease in all companies, is modest without appearing bashful, and self-possessed without an undue forwardness of manner.

The Art of Conversation.

To one who would make his way in the society of intelligent people, a well-selected fund of information and anecdote is a highly important prerequisite. An enlightened understanding and a store of interesting knowledge are essential to him who would shine in conversation. None can hope to make small talk go far with people of culture, and all who wish to win credit in social circles will need something deeper and more enduring than chat on passing trifles and local events.

The faculty of communicating thought is, in a great measure, peculiar to man, and the pleasure which he derives from the interchange of ideas is one of his leading elements of enjoyment. There is nothing more agreeable to most persons than pleasant, sprightly, fluent conversation, spiced with anecdote, and seasoned with the results of good reading, and we are all happily constituted to take delight in the mutual interchange of thoughts.

The best rule of conversation undoubtedly is, to "adapt yourself to your company." Thus commercial men enjoy conversation on subjects having some relation to affairs of business; men of pleasure, whose thoughts are given only to entertainment, prefer light talk on pastimes or social events; and professional men love to dwell on new books, the discoveries of scientists, the latest doings in the arts, and similar learned subjects.

Attention to these suggestions will be of use in helping men of learning and men of pleasure alike to derive mutual advantage from their different qualifications, and we need but say further that those who wish to please should be well informed on subjects of most general interest, whether this interest be of temporary or permanent character. An accurate and extensive knowledge on learned subjects is far from being sufficient for conversational needs, and may lead to prosy and wearisome talk in the opinion of less erudite people; one must also have a ready knowledge of the common occurrences of life, and of important events which are arising day after day, must know something of the fine art of chatting, and how to spice heavy subjects with anecdote and illustration. The art of conversation is a difficult one to acquire, and fine conversers must be born with a native faculty in that direction.

Avoid Heated Argument.

Speech is so vital an element of social intercourse that too much attention cannot be given to its requisites, or too much study to its cultivation.

In conversation it is of high importance to avoid heated argument. Difference of opinion is likely to arise very frequently, but one should always express his views calmly and gently, and avoid all eager or loud assertion. It is not so important that you should force your auditors to accept your special views. If your antagonist begins to grow warm, you should at once put an end to the argument by a quiet turning of the conversation. Disputes severely try the temper of many men, and are likely to end in the mortification of one disputant, generally with no advantage to the victor. They should, therefore, be avoided.

Yet no one is called upon, for the sake of avoiding argument, to give a general assent to all that is said in company. Assent without conviction indicates a mean and subservient spirit, and may tend to confirm others in wrong opinions. Yet it is wise to oppose calmly and correct with gentleness, and, while showing that you have a mind of your own, to show that you respect the opinions of your companions.

Consider the Feelings of Others.

Do not speak in a loud voice or assume a dictatorial tone, and if a statement is made which you know to be incorrect, be careful of the manner in which you correct the speaker. Suggest a correction, rather than make it; and if the matter is unimportant it is far better to let it pass unnoticed. There is nothing more unwise than to insist on trifles. Those who go abroad to correct the world's mistakes are apt to find themselves very frequently in hot water. If addressed in an offensive tone, it is the part of wisdom not to notice it; an intention even to insult or annoy can safely be passed over for the time being. One should consider the feelings of the other persons present, and not annoy them with personal affairs of a disagreeable character, nor permit others to force him into a quarrel in company. There is, of course, a limit of insult which a self-respecting man can not let pass; but to bear and forbear is the part of good manners. Quarrels can be left to bide their time, and there is no better way of repelling an inuendo than by ignoring it or treating it as unworthy of notice. Such a thing as a "scene" in society is, above all things, to be avoided. It is the insulter who loses social caste, not the insulted.

Care in the Use of Witticisms.

If you have wit, or fancy you have, which is oftener the case, it is well to use it with caution and judgment, and particularly to avoid seeking butts for your wit among your associates. Wit is a quality which all admire, yet which most fear, and which no one enjoys being made the victim of. If used in a satirical manner it is often malignant in character, and any man possessed of this cutting weapon may find much better occasions for its use than against the self-love or the foibles of his acquaintances. A wise man, indeed, will live as much within his wit as within his income, and it is far better to be content with good sense and reason, which can never hurt, than with this shining but cutting plaything of wit. However you may be admired for your sharpness of repartee, it is still true that respect and affection can be won only by good sense and amiable consideration of the feelings of others.

There is a species of minor wit, that known as raillery, which is much used, and much abused. It is a dangerous and mischievous weapon in unskilful hands, and had better be left entirely alone. In truth, the injustice of a bad man is often more quickly forgiven than the insults of a witty one. The former injures us in property; the latter hurts us in soul, mortifying that secret pride which we all possess. Raillery, indeed, is not always offensive; it may even be used to flatter, as when we accuse one of faults which they are notoriously free from. But this sort of raillery needs a skilled hand to manage, and had better be left quite alone if it cannot be handled judiciously.

All can be Agreeable.

It is not given to every man to be a brilliant talker, or to express himself in writing with elegance or force. Both of these are gifts of the few, not possessions of the many. There is, however, no reason why any person who goes into society should be ignorant of the rules of polite intercourse, or fail to master all the customary forms of address.

It is almost useless to repeat that your conversation should be adapted to your company, for that is a golden rule which one should know almost by intuition. In mixed groups one should sedulously avoid all such mooted points as politics and religion, and every topic likely to excite argument or lead to heated discussion.

You cannot be too careful in avoiding, in mixed assemblages, subjects which may prove to point directly to some persons present. For instance, do not speak of the laxity of the divorce laws when Mr. M. or Mrs. N. may, unknown to you, have passed through the divorce court. And do not express yourself strongly against second marriages, when there may, perhaps, be one or two examples among your listeners. If a sudden silence, with perhaps a conscious look, follows your words, you had better change the subject as quickly as possible, and be glad that you have escaped from a hornets' nest without a sting.

Avoid Referring to Your Own Exploits.

Talk of yourself and your own affairs as little as possible, and bear in mind that to drag into a general conversation the names of distinguished persons to whom you may be related, or who may be numbered among your friends, is more apt to excite contempt than to yield admiration. To speak of your own exploits, or give examples of your special prowess and sagacity, without request of the company, is always in bad taste, and is more likely to gain you credit for self-conceit than for the qualities boasted of. Leave matters of this kind for people to find out and you will gain more credit.

Above all, avoid any effort to monopolize the conversation. It is presumptuous and offensive in any person to imagine that his or her words alone are of interest, and impolite to rob others of the opportunity to speak. This is a common fault in fluent talkers, who are, besides, often so interested in what they wish to say as to be plainly inattentive to what others are saying.

Personal allusions or flattering remarks are often in very bad taste. Words spoken in jest may be taken in earnest, and should be guarded against unless you are with intimate friends, who will not be likely to put a false construction on your words. If you intend a jest, you are wasting your effort if your point cannot be seen.

Puns and slang terms should, as a rule, be avoided. They at times fit in neatly, but a habit of indulging in them is a bad one. It must be remembered that there is a slang of the mansion as well as of the hovel, of the drawing-room as of the street. The technical terms of professions or trades have occasionally the effect of slang in general society, and simple, plain language should always be used in preference. It is not always advisable to bring the phrases of the office or the factory into social circles.

Express yourself simply and clearly. Avoid all attempts at elegance or pomposity. Use the easiest and plainest language you can, and stop speaking when you have said what you desired. "Brevity is the soul of wit," therefore "speak little, but speak well, if you would be thought a person of good sense."

Other Rules Worth Observing.

Should a person enter the room in which you are conversing, and the conversation be continued after his arrival, it is only courteous to acquaint him with the nature of the subject to which it relates, and to give him an idea of what has passed.

Be cautious in relating anecdotes. Unless you can tell a story with ease and effect, it is better not to attempt it, and, above all, do not mimic the peculiarities, infirmities, or short-comings of others in general society. You may give offense to some one present who is a friend of the person caricatured, and in any case such a proceeding is not commendable.

Do not speak of what passes in a house that you are visiting. To do so may often give great offence.

You need not tell all the truth unless to those who have a right to know it all. But let all you tell be the truth.

Do not offer advice unless you know it will be followed, and carefully beware how you advise an angry or an opinionated person. As a rule, advice not asked is not welcomed.

Be cautious as to asking questions. The reply may be very embarrassing to the person of whom the question is asked.

Do not volunteer information, especially in public; but be very sure you are correct in what you state as facts.

Do not sit dumb in company, but bear your share in the general conversation. Do this with modesty and self-possession, neither thrusting yourself forward, nor hesitating where you should speak. It is better to be a good listener than a good talker, yet it is a duty to take your part in entertaining.

It is not necessary to express your opinions upon all subjects; but if you give utterance to them, do so fearlessly, frankly, and with courteous regard for the opinions of others. The greater your learning, the more modest should be your manner of expressing it.

A Winning Manner.

Another important element of social deportment is a graceful and easy bearing, and that softness and amiability of manner which is so engaging in our intercourse with the world. Such a manner is more easily felt than described. It is a compound of several elements of character and conduct; not a servility of demeanor, but an affability and courtesy in speech and expression; and this, whether or not you agree with the person or persons with whom you are conversing.

This should be particularly considered when we are obliged to refuse a favor asked of us, or to say what cannot be very agreeable to the person to whom we say it. If we have a bitter pill to administer, we should at least seek to sweeten it with courtesy and kindness. Yet this softness of manner will sink into a mean and timid complaisance, or insincere affectation, if not supported by firmness and dignity of character; and one should, while cultivating courtesy, be careful to avoid insincerity or fear of truthful expression. To be winning at the expense of truth and honesty is to convert a virtue into a fault.

Genuine easy manners result from a constant attention to the relation of persons and things, times and places. When we converse with one much superior to us in station or in the world's appreciation, we should seek to be as easy and unembarrassed as with our equals, avoiding sedulously any show of servility or flattery, yet indicating in word, look and action, the greatest respect. In the society of our equals greater ease and liberty are allowable; but they, too, have their proper limitations. There is a social respect in every case necessary, and though our language may have a greater degree of latitude among friends and equals, its freedom should never be unbounded. It is always safer to say too little than too much.

An engaging ease of carriage and behavior widely differs from negligence and inattention, and by no means implies that one is justified in consulting only his own pleasure in society; it only means that he should not be formal or embarrassed, disconcerted or diffident. It need only be said that the thing it is correct to do should be done with ease and ability; the improper thing should not be done at all.

In mixed companies different ages and sexes should be differently addressed. Although it is our duty to be respectful to all; old age particularly requires to be treated with a degree of deference and regard. It is a good general rule to accustom ourselves to have a kindly feeling towards every thing connected with our fellows, and when this is the case, we shall seldom err in the application. The inward feeling will appear in the outward conduct.

Principles of Politeness.

Another important point in decorum is, not to force upon others our own present humor or passing sentiment, but to observe and adopt theirs. If for the moment we are impressed with some strong feeling or in a humor out of tone with that of the company, we should either restrain ourselves, keep silent, or confine our conversation to those who are most likely to be in sympathy with our frame of mind. Peremptoriness and conceit, especially in young people, is contrary to good breeding: they should seldom seem to dissent, and always use some softening mitigating expression.

There is a decorum also with regard to people of the lowest degree; a gentleman observes it with his coachman, and even indeed with the beggar in the street. He considers them as objects of compassion, not of insult; he speaks to neither in a harsh tone, but corrects the one gently, and refuses the other with humanity.

Politeness is one of those social virtues which we never estimate rightly but from the inconvenience of its loss. Though perhaps not distinctly perceived when present, its absence is strongly indicated. The difference between a polite person and one who is impolite is very marked, yet those who do not possess good breeding rarely understand its importance and worth. But as sickness shows us the value of health, so a little familiarity with those who do not trouble themselves to contribute to the gratification of others, but regulate their behavior merely by their own will, will soon make evident the necessity of established modes and formalities to the happiness and quiet of common life.

Wisdom and virtue are by no means sufficient, without the supplemental laws of good breeding, to secure freedom of manners from degenerating into rudeness, or prevent self-esteem from developing into insolence. Incivility and neglect of proper social observances do not necessarily yield remorse of conscience or reproach from reason in those who have not been taught to consider the feelings of others as well as their own. Yet genuine politeness always gives ease and pleasure, while its opposite is likely to impart pain or disgust. The power of pleasing must in great part be conferred by nature, though in a considerable measure it may be cultivated. But though it be the privilege of the few to charm and shine in society, yet all may hope, by the cultivation of good breeding and polite manners, to make themselves agreeable to their associates, though they should have no claim to higher distinction.

The axiom from which flows all the formalities of cultivated society is: "Let no man give preference to himself." This is a comprehensive rule, and it is difficult to imagine an incivility unless it is in some measure broken.

Good Breeding.

Yet there are everywhere particular ceremonial requisites of good breeding, often of local application, which, being arbitrary or accidental, can be learned only by residence and observation. Among these are forms of salutation, gradations of reverence, and various rules of place and precedence. Yet these may be violated without giving offence by one who is evidently a stranger to them, and when it is apparent that neither malice nor pride had a share in their non-observance. And however rigidly these and other rules of behavior be observed, they can never condone insolence or selfishness. True courtesy is that which flows from the heart, not that which is worn only on the surface.

Real good breeding is not always to be found among those who spend their time in visiting, in frequenting public entertainments, in studying ceremonial rules, and in keeping in pace with the changes of fashionable regulations. Such people may know what fashion demands in acts of deportment and ceremony, but they too often confine themselves to the exterior and unessential elements of civility, and are much too apt to consider their own gratification as of more value than the pleasure of others.

The most certain way to give any man pleasure is to persuade him that you receive pleasure from him, to encourage him to freedom and confidence, and to avoid any such appearance of superiority as may overbear and depress him. We see many who, by this art alone, spend their days in the midst of caresses, invitations, and civilities; and, without any extraordinary qualities or attainments, are the universal favorites of both sexes.

In assemblies and places of public resort it is frequently observed that at the entrance of some particular person every face brightens with gladness, and every hand is extended in salutation. Yet, often, if you follow this favorite beyond the first exchange of civilities, you will find him of only ordinary abilities, and welcome to the company simply as one by whom all conceive themselves to be admired, and with whom any one is at liberty to amuse himself when he can find no other auditor or companion. He can place all at ease if he will hear a jest without criticism, and a narrative without contradiction, laugh at every wit, and yield to every disputer.

All are at some hour or another fond of companions whom they can entertain upon easy terms, and who will relieve them from solitude, without requiring them to guard their speech with vigilance and caution. We are most inclined to love when we have nothing to fear, and he that encourages us to please ourselves, will not be long without preference in our affection to those whose learning holds us at a distance, or whose wit calls all attention from us, and leaves us without importance and without regard. All men dislike to be placed in such unpleasant contrast, even though they cannot but admire the abilities which they are incapable of rivalling or even unable to imitate.

The Demeanor of a Lady.

An agreeable, modest, and dignified bearing is not only one of the most desirable requisites of a young woman, but her best warrant to claim the title of lady. Whatever may be the transient demand of fashion, whatever the passing rule of custom, that which is amiable, graceful and true in taste will always please the majority of mankind. A young lady, if she have any true claim to the title, should not require to have allowances made for her. If properly trained, and blessed with a just conception of social requisites, her address will be gentle and polite, her manner courteous, and she will need but an opportunity for observation to gain those minor graces and habits which the local customs of society may demand. The general rules of social observance are world-wide in their application, and familiarity with them flows almost inevitably from good sense and a good disposition.

On being introduced to a stranger, there is no insincerity in the display of a degree of pleasure. The well-trained girl will acknowledge the introduction to an elder person with a respectful bow and a deferential manner. To one of her own age she will strive to make herself agreeable even if not particularly attracted towards the person introduced. It is the excess of impoliteness to let it be seen that she does not care for her new acquaintance, to look over her dress at once, as if taking an inventory of it, to wear a supercilious manner, or to appear hurried, as if anxious to get away at the first break in the conversation. Politeness demands that she should show a degree of pleasure in the introduction, and courtesy, that she should avoid any action likely to give pain or offence.

Incivilities to be Avoided.

Such suggestions are hardly necessary. The instinct of a true lady will teach her to observe these basic rules of courtesy. Yet there is a heedlessness in many of the young, and an unacknowledged selfishness, which often lead to incivilities of which they are themselves unaware.

In conversation volubility is to be avoided. The words should be gently spoken, and the voice loud enough to be heard easily, but still with a degree of repression, an undertone below the full powers of the voice. Affectation especially should be avoided. It was once in fashion, but was always strained and unnatural, and, fortunately, has long ceased to be the mode. Like many peculiarities of bygone times, one meets with it now only in vulgar society. The well-bred sedulously avoid affected tricks of speech.

The manner of using the eyes also calls for regulation. The open stare and the shy withdrawal of the eyes are alike to be avoided. They should be raised quietly and with interest to those of the speaker, and only withdrawn when his remarks are concluded. This, of course, is not necessary if he is speaking to a number, but even then the eyes should not indicate inattention, and should be more or less steadily fixed on the speaker's face.

There is, in addition, a certain dignity of demeanor necessary to make even the most superior persons respected. This dignity cannot readily be taught; it can hardly be assumed; it must flow in great measure from intrinsic qualities, though even the finest natural powers may lose their influence through carelessness, and may be enhanced by attention and training. This dignity is distinct from pretension, which yields disgust rather than respect. A true lady will be equal to every occasion, and at home in all grades of society. Her politeness, her equanimity, her presence of mind, should be in evidence alike in the court and in the cottage.

Private vexations should never be allowed to affect a lady's manners, either at home or elsewhere. If not in condition for society, she should refrain from entering it, remembering that every one is expected and should hold herself bound to add something to the general sum of enjoyment. The self-control required in good society is often beneficial alike to the temper and the spirits.

Many a plain woman has won and kept the affection of others merely by being always gentle and womanly in manner. To gain an empire over the affections there must be somewhat of sentiment or sympathy in the nature of a woman. The loud, boastful, positive young lady will never be remembered with a soft interest, unless there be, perchance, some gentle strain in her that redeems her from her assumed hardness.

Flirtation.

With regard to flirtation, it is difficult to draw a limit where the predilection of the moment softens into a more tender and serious feeling, and flirtation sobers into an earnest form of devoted attention.

We all dread for our daughters hasty and questionable attachments; but it must not be supposed that long-practiced flirtations are without their evil effects on the character and manners. They excite and amuse, but they also exhaust the spirit. They expose women to censure and misconstruction, and tend to destroy the charm of manners and the simplicity of the heart. The coquette should remember that, with every successive flirtation, one charm after another disappears, like the petals from a fading rose, until all the deliciousness of a fresh and pure character is lost. On all these points a woman should take a high tone in the beginning of her life. She will learn, as time goes on, how far she may consistently lower it into an easier and more familiar tone of social intercourse.

The bearing of married women should so far differ from that of the unmarried that there should be greater quietness and dignity; a more close adherence to forms; and an abandonment of the admiration which has been received before marriage. All flirtation, however it may be countenanced by the existing custom of society, should be decisively put aside. There is, however, no reason that conversation should be less lively, or society less agreeable.

If a young married woman wishes to be respected, and therefore happy in life, there should be a quiet propriety of manner, a dignity towards the male sex, which cannot be mistaken in her for prudery, since it is consistent with her position and her ties. She should change her tone, if that has been unrefined; she should not put herself on a level with young unmarried women of her own age, but should influence and even lead her youthful acquaintance into that style of behavior which is much esteemed by men of good taste.

Demeanor of a Gentleman.

One must be a gentleman before he can act the gentleman. To put on a semblance of what we do not possess is simply to expose ourselves to the world, which will not be slow in discovering the false show, and ridiculing or despising the hypocrisy. May good breeding be acquired as an art? Yes, in a measure, so far as dress, ceremonial deportment, and outward display of gentility go. One may ape the gentleman, even while not being the gentleman. Yet there is a something beyond this, visible in every word and tone, which makes the true gentleman, and to gain which one must train his heart as well as his manners.

In the well-chosen words of Ruskin: "A gentleman's first characteristic is that fineness of structure in the body which renders it capable of the most delicate sensation, and of that structure in the mind which renders it capable of the most delicate sympathies—one may say, simply, 'fineness of nature.' This is, of course, compatible with heroic bodily strength and mental firmness; in fact, heroic strength is not conceivable without such delicacy. Elephantine strength may drive its way through a forest, and feel no touch of the boughs; but the white skin of Homer's Atrides would have felt a bent rose-leaf, yet subdue its feelings in glow of battle, and behave itself like iron. I do not mean to call an elephant a vulgar animal; but if you think about him carefully, you will find that his non-vulgarity consists in such gentleness as is possible to elephantine nature; not in his insensitive hide, nor in his clumsy foot, but in the way he will lift his foot if a child lies in his path; and in his sensitive trunk, and still more sensitive mind, and capability of pique on points of honor. Hence it will follow, that one of the probable signs of high breeding in men generally will be their kindness and mercifulness; these always indicating more or less firmness of make in the mind."

What Constitutes Gentlemanly Manners.

The manners of a gentleman are the index of his soul. His speech is innocent, because it springs from a pure spirit. His thoughts are direct, because they are the exponents of upright actions. His bearing is gentle because it arises from gentle impulses and kindliness of heart. Pretentious manners are alien to the nature of the true gentleman. He avoids instead of exacting homage. Ceremonies do not attract him. He is as ready to do kindly acts as to say civil things. He regulates his hospitality by his means, but graces it with heartiness and sincerity of welcome. He chooses his friends for qualities akin to his own, his servants for truthfulness and honesty, his occupations for their elevating tendency or their power of giving aid or enjoyment to others. In a word, a good heart is at the bottom of all his acts, and a kindly spirit is the fountain from which all his thoughts arise. In this consideration it will not be amiss to quote from Ward McAllister the following apposite passage: "The value of a pleasant manner it is impossible to estimate. It is like sunshine, it gladdens; you feel it, and are at once attracted to the person without knowing why. When you entertain, do it in an easy, natural way, as if it was an every-day occurrence, not the event of your life; but do it well. Learn how to do it; never be ashamed to learn. The American people have a *greater* power of 'catching hold' and adapting themselves to new surroundings than any other people in the world. . . .

"If women should cultivate pleasant manners, should not men do the same? Are not manners as important to men as to women? The word 'gentleman' may have its derivation from gentle descent, but my understanding of a gentleman has always been that he is a person free from arrogance and anything like self-assertion; considerate of the feelings of others; so satisfied and secure in his own position that he is always unpretentious, feeling he could not do an ungentlemanly act; as courteous and kind in manner to his inferiors as to his equals. The best-bred men I have ever met have always been the least pretentious. Natural and simple in manner, modest in apparel, never wearing anything *voyant* or conspicuous; but always so well dressed that you could never discover what made them so,—the good, quiet taste of the whole producing the result.

"Here all men are more or less in business. We hardly have a class who are not. They are, of necessity, daily brought into contact with all sorts and conditions of men, and in self-defense oftentimes have to acquire an abrupt, a brusque manner of address, which, as a rule, they generally leave in their offices when they quit them. If they do not, they certainly should. When such rough manners become by practice a second nature, they unfit one to go into society. It pays well for young and old to cultivate politeness and courtesy. Nothing is gained by trying roughly to elbow yourself into society, and push your way through into the inner circle; for when such a one has reached it, he will find the atmosphere uncongenial, and be only too glad to escape from it."

The Demands of Etiquette.

Etiquette makes many demands upon a man, demands which cannot safely be set aside, if he wishes to preserve the high title of gentleman. It is his duty to answer letters, notes, and invitations without delay. He must dress neatly; there is no need that he should dress lavishly. To dress well is to dress appropriately. He must be deferential to the old and courteous to the young, and yield place and precedence to women—the older in preference.

If he be afflicted with physical or mental ailments, let him bear them as philosophically as possible, and, at all events, avoid speaking of them in company. If he be placed under obligation, he should not let it remain any longer than he can help—if it be of a kind that can be returned.

It is not the large, but the little, things that often test and try a man's character and disposition. These make up the bulk of existence. We are rarely called upon to act the hero; we are daily required to act the gentleman.

"Among these trifles light as air," says a recent writer on etiquette, "is the ever-recurrent and not a little vexing question of the payment of fares in a car or omnibus by an acquaintance, and the adjustment of such matters."

In the opinion of this writer, there is only one rule about paying a lady's fare under such circumstances, and that is, "Don't offer to do it," unless called upon to do so through trouble on her part in making change or other exigency.

Women do not altogether like to be put under an obligation of this kind; some do not like it at all, feeling that it is not easy to repay. If she seeks to return the sum, it should be accepted without hesitation. There is no honor gained by attempting to appear magnanimous about a trifle.

Etiquette of Travel.

As regards offering a seat in a street car, that is a matter which should be governed by circumstances. There is no call for an oldish or tired man to give up his seat to a young woman, who is evidently better able to stand than himself. For a young man to give up his seat is a different matter, but in doing so preference should not be given to youth and beauty, as is too often the rule. True courtesy demands that the seat should be offered to the woman evidently least able to stand, no matter whether she be well or ill dressed, handsome or the opposite, rich or poor.

These instances are offered simply as examples of those small occasions for consideration and courteous demeanor which are of daily occurrence, and which are apt to be truer tests of character than many of the greater exigencies of life. There is a streak of selfishness, or, at the least, of self-indulgence, in us all to whose counsel it is dangerous to listen, if we desire to wear at least the outer aspect of a gentleman. The man who is a gentleman by nature needs no suggestions on these small points; instinct will tell him how to act. Yet in all cases some training in the customs and observances of good society is of utility. The readiness to do the right thing is not all there is to consider. A knowledge of what is the right thing to do in the daily exigencies of life is of equal importance to all.

II. THE ART OF DRESS

The fashion of attire is a question of the passing day; its æsthetics is a question of the ages. Persons of taste will avoid the ridiculous, whatever may be the demands of fashion, yet will not vary so far from the prevailing custom in dress as to expose themselves to ridicule from singularity.

Dress has in it some of the essentials of the fine arts, and to be well dressed requires other requisites than the possession of wealth and a good figure. Good taste and refinement stand first; all other essentials come second. To dress well, the qualities of color, harmony, and contrast need to be observed, and a trained and artistic eye is as essential as a sensible and well-balanced mind. Dress, to be in good taste, by no means needs to be costly. Fit, proportion, and harmony in shade and color are the objects to be observed, and while there should be a reasonable consideration of the dictates of fashion, no person of sense will follow fashion blindly, to the neglect of the essentials of adaptation to figure, face, and occupation.

A Well-Dressed Woman.

Some one says that "as a work of art a well-dressed woman is a study." The toilette of such a person is always well-chosen, with consideration of its purpose, and is always adapted to the situation, whether it be breakfast-room or ball-room, promenade or reception. If she loves bright colors, and they agree with her complexion, they will be as harmoniously arranged as the tints of an artist. If subdued colors are demanded, she will not let any desire for display lead her into the use of garish tints. If she is young, her dress will be youthful; if she is old, it will avoid showiness. She will always rather follow than lead the prevailing fashion, and in no event will permit the costume of the day to lead her into violation of good taste and common sense.

The golden rule in dress is to avoid extremes. To affect peculiarities of costume shows a lack of good taste, while it is not less unwise to follow fashions which are unbecoming to the special person. Ladies who are neither very young nor very attractive in appearance will do best to wear quiet colors and simple styles; while those who are not rich can always appear tastefully dressed, if they exercise care in the choice, and display skill and judgment in the arrangement of materials. A dressmaker of good taste is an essential to good dressing. The dressmaker is a woman's good or evil genius, and may do much to make or mar her position in social circles.

Dress for Various Occasions.

Morning dress should be faultless in its way. For young ladies, whether married or single, there is no prettier summer morning wear than white or very light dresses of washing materials. Yet those must be always fresh and clean, and the collars and cuffs irreproachable. For morning wear simplicity in attire is imperative. Silk should not be worn. Cotton and woolen are the proper materials.

The walking-dress should be quiet. A rich or showy dress in the street is apt to attract more attention than is desirable or always agreeable. For the carriage, however, a lady may dress as elegantly as she wishes.

Elderly ladies should dress as richly as their means permit. A thin old lady may wear delicate colors, while one of stout person or florid complexion will look best in black or dark grey. But for young and old alike the complexion and figure have much to do with determining the suitable colors. Rich colors harmonize well with brunette complexions, but for blondes and those of delicate tints of face the desirable colors to be worn are those of more delicate hue.

At dinner parties, unless they be small and familiar in kind, only the fullest dress is appropriate. But at unceremonious dinners demi-toilette can be worn, and high dresses if the material be sufficiently rich. Real flowers may be worn at dinner parties, but it is better to wear artificial ones at balls, since the heat and dancing are apt to cause real flowers to droop and shed their petals.

Gloves, shoes, and boots must always be faultless Gloves cannot be too light for the carriage, or too dark for the streets. A woman with ill-fitting gloves lacks one of the essentials of suitable dress. It may be remarked, by the way, that perfumes should be used only in the evening, and with the strictest moderation, and that perfumes to be tolerable must be of the most delicate kind.

There has never been a more telling and sensible criticism than that made by Dr. Johnson on a lady's dress. "I am sure she was well dressed," he said, "for I cannot remember what she had on."

Suitability of Apparel.

Suit your dresses to the occasions upon which they are to be used. In the morning, at home, a lady may wear a loose, flowing dress, made high in the neck, with a belt at the waist, and with loose sleeves fastened at the wrist. On the street a walking-costume should be worn, and the dress should clear the ground. There is nothing more disgusting than to see a rich dress sweeping up the dirt and filth of the street.

Fashion seems to decree this at the present time, with the ungraceful result of seeing nine women out of ten awkwardly holding up their skirts. The tenth sensibly ignores fashion in favor of comfort.

The shoes for the street should be high, warm, and easy to the feet, with a low, broad heel, and should be always neatly blackened. For ordinary street wear a lady may use either a hat or a bonnet. This is a matter of taste. In the dress of ladies great latitude is allowed; but the aim of all who aspire to be well dressed should be simplicity and taste, the character of the occasion being always carefully considered. Latitude or great variety in dress is no longer thought original, and startling innovations are dangerous experiments. With artistic taste they may prove a success, but are much more likely to be a failure.

It is important that a lady should always dress neatly at home. She is then ready to receive a morning caller without having to change her dress. She should change her dress for the evening. Some neat and dainty costume should be worn, according to her taste, for it is in the evening that she is thrown most with the male members of her family, and is most likely to have visitors. In making evening calls upon her friends, a lady should wear a hood, or some light head-wrap easily laid aside. A bonnet should always be removed at the commencement of such a visit.

Public Occasions.

The fashion of the time must govern the evening dress for public occasions. Full dress must always be worn, but it is impossible to give any fixed rule regarding it, in view of the frequent changes in the demands of fashion. A competent dressmaker, or the fashion publications of the time, will give the necessary information. In Europe, the evening dress requires the exposure of the arms and neck; but in this country the more sensible plan of covering these parts of the body is widely the fashion, and should be observed except on very special occasions.

The dress for balls and soirees should be of the richest within the lady's means. Yet a certain degree of repression is important, if one would avoid seeming overdressed. White kid gloves and white satin or kid boots are most suitable to a ball dress. If the overdress is of black lace, black satin shoes are worn. Hints and directions, however, are of little need to ladies for occasions of this kind. Example and experience, either of themselves or their friends, will prevent them from going far wrong.

The richest full dress should be worn at the opera. The head should be bare, and dressed in the most becoming style. Jewelry may be worn, according to taste, as there is no place where it shows to better advantage. A light or brilliant colored opera cloak will add greatly to the lady's appearance and comfort. Gloves of white, or delicately tinted, kid only are to be worn. The ordinary walking-dress, however, is suitable for other places of amusement. A rich and elegant shawl may be worn, as it can be thrown off when uncomfortable. The sensible fashion is now making its way to remove the hat at theatres and lectures, out of due regard for those whose view of the stage may be obstructed. This being the case, there is no need to spoil the hair by wearing hat or bonnet on the way thither.

Plain and simple dress should be worn for church, with very little jewelry. The costume should be of quiet colors. It is a mark of bad taste for ladies to attend church elaborately or conspicuously dressed. It shows a disregard for the solemnity of the sanctuary, and is calculated to draw off the attentions of others from the duties of the place.

Jewelry.

Much display of jewelry is out of place for young ladies, and the kind of jewelry to be worn demands as careful consideration as that of the dress itself. Diamonds, pearls, and transparent precious stones generally belong to evening costume, and are always in taste at night; but they should not be worn in the earlier parts of the day. In the morning, indeed, only a simple ring or two are admissible, with, perhaps, a gold brooch, and a watch and chain.

As regards cost of jewelry, it is by no means the best criterion of taste. A simple and inexpensive jewel may occasionally have the effect of an exquisite work of art, while a large and showy brilliant may give the impression of vulgar display or showy overdress. To wear much jewelry in the streets is in very bad taste, while in large cities it may subject the wearer to danger from robbery.

In traveling it is inadvisable to make a display of jewelry. It is particularly undesirable if a lady is traveling alone, for the reason just given.

Traveling Dress.

Traveling costume should be simple in style and quiet in color, materials that will not show dirt being preferable. A waterproof cloak is a very desirable addition, as it may be at any time suddenly needed. In summer travel a long linen duster, belted at the waist, should be worn over the dress.

For the country or sea-side, simple and inexpensive dresses should be provided for ordinary wear. The bonnet should give place to a hat with a brim sufficiently wide to shield the face and neck from the sun.

Bathing dresses should be made of blue or gray flannel. The skirt should come down to the ankles, and the sleeves should be long. An oil silk or India-rubber cap, fitting tightly around the head, will protect the hair from the salt water.

It is impossible to prescribe an exact style or mode of dress for ladies in all places and on all occasions. Fashion will change, and, it must be confessed, in the matter of female costume, its changes have often been for the better.

In regard to "overdressing," it is not easy to draw a line, customs in different localities varying so much that what is permissible in one place might be utterly out of place in another. The usual thing for winter dress is a stuff dress—a "cloth suit," it is usually called—worn with a fancy bodice. For elderly women, with money enough to afford it, costumes of silk, with elaborate trimming, are often worn. With toilettes of this kind the custom of wearing lace is on the increase; but these are matters which the dressmaker is most competent to decide upon at any fixed period. As a general rule, however, loud colors should be avoided, and it is best never to risk extremes of costume, whether in or out of the line of fashion, if one wishes to escape the verdict of vulgarity.

A Well-Dressed Man.

Buffon has remarked that a man's clothes are a part of himself, and enter into our conception of his character. And certainly no man who is experienced in the ways of the world and has any regard for social opinion can consider the question of dress as unimportant. We may excuse a man who dresses very negligently, but we rarely hold him in any high regard. Our conception of the interior qualities of a person is influenced, more than we are ordinarily aware, by his exterior appearance.

Walpole truly says: "We must speak to the eyes, if we wish to affect the mind."

In paying a visit, or in mingling in good society, it is complimentary to our hosts to be well dressed, and shows disregard of their wishes to be slovenly in attire. Even in a casual meeting, or in cases where the costume is likely to be of minor consideration, neat and careful dressing is very likely to be of advantage. A negligent attire indicates that a man is heedless of the opinions of others, and indifferent to their good will or respect.

A careful and neat attire, on the contrary, indicates a man who has a regard for himself and for the sentiments of others, one who finds pleasure in social intercourse, and loves to mingle in the society of his fellows. It is a kind of general offer of acquaintance, and proves a willingness to be accosted. Dress is the livery of good society, and he who would advance in the profession of pleasing must pay due regard to his outward aspect.

Dress is also significant of inner feeling, and expresses qualities of mind which are likely to affect the outward conduct. That courtier was not far astray who dated the beginning of the French Revolution from the day when a nobleman appeared at Versailles without buckles on his shoes.

Fashion is called a despot; but if men are willing to be its slaves, we cannot, and ought not, to upbraid fashion. In truth, the man who rebels against fashion is often more open to the imputation of vanity than he who obeys it, because he makes himself conspicuous, and practically announces that he is wiser than his kind. Affectation is always the essence of vulgarity. Between the two it is left to the man of sense and modesty to follow fashion only so far as not to make himself peculiar by opposing it, and in whatever he does or whatever he wears to let good taste, common sense, and a proper regard for the opinion of his fellows be the guides of his conduct.

A prime requisite in dress is its simplicity, with which may be coupled harmony of color. This simplicity is the only distinction which a man of taste should aspire to in the matter of dress, for simplicity in appearance must proceed from a nicety in reality. One should not be simply ill-dressed, but simply well-dressed.

All extravagance, all over display, and all profusion must be avoided. The colors, in the first place, must harmonize both with our complexion and with one another; perhaps most of all with the color of our hair. All bright colors should be avoided, even in gloves and neck-ties. The deeper colors are, somehow or other, more manly, and are certainly less striking. The same simplicity should be studied in the avoidance of ornamentation.

Appropriate Costume.

You should dress according to your occupation and means. If you are a salesman, you would not think it appropriate to appear in the regulation garb of a bishop. Good sense and good taste form the first rule, and about the only one to be considered.

In the shifting climate of our country, gentlemen of late years have very sensibly adopted the mode of dressing especially for comfort. They have to brave all kinds of weather, sometimes wade through mud and slush, sometimes face a summer shower or cyclone, and they find it more essential to be protected against these climatic changes than to appear in elegant costume.

Their dress does not undergo so many modifications as that of ladies, and it is comparatively easy for them to wear apparel that will be simple and serviceable, and at the same time in good taste.

There is much less to be said about the dress of men than of women, as it is not subject to such extreme changes or susceptible of such great diversity in color, cut, and material. For the day the business suit is the usual costume, black or dark in color, with shoes of black or tan leather, and a derby or a soft hat. Those who desire a reputation for dressing well will scarcely appear in a high hat and tan shoes together.

Sack coats or cutaways can be worn with tweed or any rough cloth trousers and waistcoat, the weight and color being varied to fit the season. As evening approaches the sack coat and business suit should be replaced by a cutaway or frock coat. In the country rough tweed suits, fancy flannels and any kind of hat may be worn, unless the gentleman is going to some special social entertainment, when he should dress much as in the city.

The Shirt Waist.

In the summer of 1900 the shirt-waist, which was worn almost universally by women, was emulated by men, many of whom assumed, during business hours, unstarched colored shirts worn without vests, while a waist belt replaced the usual braces. Often the coat was discarded. The comfort of this attire during the heated term was so great that the "shirt-waist man" promises to become a recognized summer institution.

As for evening dress, a considerable latitude of opinion concerning this prevails. During the warm season—from June to October—comfort demands much laxity in this respect. As evening dress is never seen in city streets without an overcoat, and as few care to swelter at the dictum of fashion, many men of sense content themselves with a neat ordinary dress. There is a variety of usage in this respect also at the theatre, and it is coming to be imperative to wear evening attire only at formal dinners or at certain fashionable assemblages which make it a requisite. In general, except during the summer, it is a safe rule for the denizen of fashionable circles to change his dress every evening, so as to be prepared for dinner or any other formal occasion. But as the denizens of fashionable circles compose a limited section of the community, an island in the sea of the multitude who claim no such exclusive honor, evening dress, as a general rule, is kept for special occasions, and men at home consider comfort and convenience far more than fashion.

III. INTRODUCTIONS.

The laws of society do not permit you to claim acquaintance with other persons unless you have been properly introduced, though in traveling this rule may often be reasonably omitted. Under ordinary circumstances care and discrimination should be exercised in making gentlemen acquainted with each other, and still greater heed is demanded in the introduction of ladies and gentlemen. It should always be understood in advance whether or not the lady is likely to desire the introduction. In no case should it be thrust upon her without regard to her objections. And it is not advisable to make the request within hearing of the party concerned, since this may put her in an awkward situation, if wishing to decline.

Do not forget that, in introducing one person to another, you assume a social responsibility for the person you introduce, and great care should be taken in giving this indorsement. It is possible for you to inflict a positive injury by introducing a man of objectionable character to a lady. If you are not well informed in respect to the reputation of the one for whom you are about to become responsible, pause and go no further. You should not be a party to the formation of any relations which may possibly have an injurious effect.

The same conditions hold good in the business world. An introduction carries with it some indorsement which may lead to business transactions involving great financial risks.

Rules of Introduction.

In England, visitors meeting in the same house are expected to enter into conversation, though no formal presentation has been made, and no previous acquaintance has existed. In the United States, however, the fashion of introducing people who meet as strangers still continues, though in certain highly fashionable circles the English fashion is affected. It, perhaps, has its advantages, in enabling visitors to converse freely without waiting for the formality of an introduction, and leaving them free not to know one another afterwards. But it has its disadvantages as well, especially in the case of shy and easily embarrassed people.

The American rule has long been to introduce generally, and in early society in this country it was deemed necessary to make everybody in company acquainted, from a somewhat forced idea of the requirements of hospitality. This wholesale custom is no longer observed, and common sense prevails in this as in social customs generally.

One should always show discretion in this observance, as in all the demands of society. It is not, for instance, advisable to interrupt a conversation for the purpose of making an introduction. The intention will wait, and even if it fails altogether no harm is usually done. Few persons will thank you for making them too conspicuous.

Of the places where an introduction is not in order we may particularly instance a church. Here it would be quite improper, not only within the building, but even at its entrance. Nor is it necessary to introduce two persons at an entirely casual meeting—in a street car, for example, or if you happen to meet an acquaintance, whom your companion does not know, at some friend's door. Of course, if the chat should be extended, or if you think it desirable that they should know one another, an introduction is perfectly admissible; but it is in no sense incumbent upon you.

One further remark in this connection may be made, in reference to the frequent failure to catch the name of the person introduced. This often causes a feeling of embarrassment, and a somewhat awkward attempt to discover the missing name. "I didn't quite catch the name,' is the most ordinary way out of the difficulty, but something more original might well be attempted, as, "Pardon my inattention to Mr. C. I was so occupied with the honor offered me as to be deaf to the name"; or, less effusively, "Will you kindly tell me again whom I have the favor of meeting?"

The trouble is worse when you immediately forget the name, and are lacking in this particular on your second meeting with the new acquaintance. It is a useful accomplishment which all do not possess, that of remembering names readily; and to be obliged to make the worn-out admission, "Your face is perfectly familiar, but I have forgotten your name," is an awkward way out of the difficulty. Better try and get through the interview in a way to escape the need of using the name, and endeavor to learn it before another meeting is likely to take place. By repeating the name in acknowledging the introduction and fastening your attention thereto, it will not be difficult to remember the name.

The Introducer's Formula.

In introductions the common formula is: "Mrs. Blank, may I," or "allow me to present," or "introduce, Mr. Smith."

Never reverse this order, and so introduce the lady to the gentleman. When the sexes are the same, present the person of the lesser to the one of the greater age or importance.

Always mention the name in introducing members of your family. Say, "My father, Mr. Simpson," "My daughter, Miss Simpson," or "Miss Ellen Simpson." Your wife should be introduced simply as "Mrs. Simpson."

In introducing persons with titles, the title should always be distinctly mentioned. Thus, you should say, in presenting a clergyman to a senator of the United States, "Senator A., permit me to introduce you to my friend, the Reverend Dr. W. Dr. W. is the rector of St. M. Church, Boston." Then turning to Dr. W., say, "Senator A. represents the State of M. in the United States Senate."

Upon meeting strangers it is well to add some pleasant remark or suggest some interest in common between them. This will serve to put them at their ease and aid them to start a conversation. The party presented may simply say, "How do you do?" or "I am glad to know you," following it with such subject of talk as may occur to him.

Introductions do not necessitate future mutual recognition, unless agreeable to the parties introduced. The ceremony is simply an opportunity offered for present acquaintance, and can be ignored by one or both parties immediately after they leave the presence of the person who made the introduction.

A gentleman should never bow to a lady when first meeting her after an introduction, until she gives him some sign of recognition, thus intimating her desire to continue the acquaintance. A gentleman should always return the bow, even though he may not care for the acquaintance.

Ladies and gentleman need not shake hands with each other when introduced. A bow is sufficient acknowledgement of the introduction. Persons of the same sex may or may not shake hands. In formal fashionable circles the hostess alone shakes hands, but ordinarily it is quite in order to offer the hand when introduced.

Persons meeting at the houses of friends when making morning calls need not be introduced to one another, and should not be unless there is good reason to believe that such introduction will be mutually agreeable. Nor is it proper for persons who have met in ihis manner, without introduction, to bow or express recognition otherwise should they again meet.

A person making a visit to your house should be introduced to every caller. At an evening party it is the duty of the host or hostess to make their guests acquainted with one another.

A gentleman should always promptly offer his services to a lady in any position of difficulty, whether he knows her or not. Her acceptance of his services does not give him any claim upon her acquaintance, nor need she feel obliged to recognize him afterwards without a formal introduction.

An introduction, however, gives one a claim upon the courtesy of another, whether the acquaintance be pleasant or the contrary. To ignore a person to whom you have been properly introduced is certainly an act of ill-breeding, and under certain circumstances becomes an act of insolence.

Salutations.

In meeting a friend upon the street, or in company, you should salute him cordially, but quietly and respectfully. A gentleman should always salute a lady by raising the hat and making a formal bow. In company, the head being uncovered, the bow alone is your salutation; but it should in either case, be a decided inclination of the head and body, not a mere nod.

In this country, among ladies, kissing is a common mode of salutation, even on the street. But indications are that this custom is less popular for hygienic reasons. Gentlemen generally shake hands, or in passing each other bow, or make a courteous motion of the hand. Even where you are not on good terms with a person it is courteous to bow to him. Should he fail to return the bow the offence is his, and you have lost nothing by your politeness.

The lady should bow first in meeting a gentleman on the street. It is her privilege to do so, as she thus shows whether she desires to continue his acquaintance or not. A failure on her part to bow first excuses the gentleman from saluting her. Among very intimate friends either party may salute first.

In riding, a gentleman raises his hat with his right hand, as the left is occupied with the reins.

When two or more gentlemen, walking on the street, meet a lady who is known to one only, all should raise their hats and bow. Those unacquainted with the lady thus show their respect for their friend's friend.

A gentleman when smoking, if meeting a lady acquaintance, should remove the cigar from his mouth and hold it down by his side before raising his hat to her. Above all, never smoke while walking or riding with a lady. She may not object to it, but that does not pardon your rudeness.

A young lady should treat an elderly person, either man or woman, with the same deference she expects at the hands of a gentleman.

Calls, Formal and Informal.

Residents of large cities should call in person upon all their acquaintances at least once a year, if circumstances permit, and should pay additional visits to all from whom invitations have been received. Calls should also be made when an engagement or marriage has taken place in the family of an acquaintance, or an acquaintance has returned home after a long absence.

The receipt of any especial hospitality, such as a dinner, luncheon, dance, etc., obligates that the recipient should call as soon thereafter as possible. If living at a distance a brief note to the host or hostess acknowledging the pleasure received is proper; especially is this expected after an extended visit. This is imperative, but it is not necessary after a five o'clock tea or an at-home, no one being obliged to follow one call with another. Such obligation as exists is for the party who gave the tea to return your call; and this is obviously impossible if her invitations have been very numerous. After being invited to visit a country house, a call should be made on those giving the invitation immediately after their return to their town residence.

In case of a newcomer to the street, or the city if a small one, older residents should call, and this visit should invariably be returned in person within a week.. Etiquette permits a gentleman—a stranger—to call upon a lady under the following circumstances: If she has invited him to call, if he brings a letter of introduction, or if an intimate friend of the lady or of the family presents him.

Custom and courtesy require that a lady shall call on her lady friends at stated times, or at moderate intervals. These calls are generally short and formal in character. the conversation being devoted to society news and similar light subjects. Ten or fifteen minutes is the usual length of a formal call, half an hour the extreme limit. If while calling a second visitor arrives, the first visitor should take leave as soon as she can do so without seeming abrupt. Special friends of the hostess may linger for an hour if they wish.

In the large cities of the East such calls were formerly made between 11 A.M. and 4 P.M., but later hours in the afternoon are now the vogue, as from three to half-past five. Evening calls, unless in response to invitation or through mutual understanding, are out of order except in small communities. They may break into the dinner hour, or interfere with a theatre party or other outing.

Of course, these rules do not refer to the intercourse of intimate friends, the informal "running in," which may take place at any time in the day or evening, and need not interfere with any engagement. Gentlemen, as a rule, have only the evening to call in, but may call on Sunday afternoon after three.

A lady, in making a formal call, should not remove her bonnet or wrap. A gentleman, in a similar case, was formerly required, while leaving his umbrella and overcoat in the hall, to bring his hat and cane into the receiving room, either holding them or placing them on the floor by his chair. This rule, however, is no longer observed, and it is optional with the visitor to leave them in the hall if he prefers.

Ladies should make morning calls in simple toilette, and not in very rich dresses. Gentlemen wear morning dress.

Ending a Call.

When a call is ended it is customary among the best bred people to ring for a servant to open the front door for a visitor. Some persons prefer to attend visitors to the door themselves; and this should be done if a servant is not called upon. It is not courteous to let a visitor find his or her way out of your house unattended.

A lady should never attend a gentleman to the door; nor a lady either, if in so doing she is obliged to leave other lady callers in the drawing-room.

It is optional with the hostess whether or not to rise from her seat and cross the room to greet a visitor, or to accompany to the door a lady who is taking her departure, in case of no other ladies being present. But in these, as in all other cases where the rules of etiquette are not imperative, it is well to remember that the course which sets the guest most at ease will always be the choice of a kindly nature.

In making a call, if the lady called upon is not at home, leave your card; and if there are several ladies staying there whom you desire to see, request the servant to present your compliments to them severally. Should you not have a card, leave your name.

When a lady visitor takes her leave, a gentleman, if present, should rise, and offer to conduct her to her carriage. The offer may not be accepted, but if it is, do not forget to return and pay your respects to your hostess before quitting the house.

In case of other visitors entering during your call, your hostess is not obliged to introduce you to them, and you should take no offence at her failure to do so. In taking leave after their entrance, do so in such a way as not to make it appear that your departure is on account of their coming.

You may make visits of congratulation upon the occurrence of any happy or agreeable event in the family of a friend—such as a marriage, a birth, or the inheritance of wealth. Such visits should be made in the morning.

You should not defer a visit of condolence beyond the next week after a death occurs in a family. Among friends such visits are regarded as an imperative duty, except where contagious diseases render them dangerous.

In calling upon a person living or staying temporarily at a hotel, wait in the parlor and send up your card. Even intimate friends should observe this rule. A gentleman may wait in the office or hall of the hotel while the waiter takes up his card.

IV. VISITING AND VISITORS

Visits of friendship are governed by no set rules of etiquette, and need not be formal either as to length or manner. It is to be presumed that friends or relatives will conform to each other's tastes and habits, and conduct themselves in a manner that will be mutually agreeable. With intimate friends strict ceremony is uncalled for, yet there are certain liberties which you enjoy at home which are not proper to take in the house of a friend.

It is a sign of ill-breeding, in such a visit, to criticise the conduct of servants or children, or anything connected with the household or the members of the family. Remarks of any kind on the faults or foibles of persons belonging or closely related to the family are sadly misplaced; and such remarks made after taking leave show a lack of good feeling which is not redeemed by being unheard by those interested. In such cases one should strictly apply the golden rule of friendship, to do nothing by act, word, or deed that may cause a disagreeable feeling on the part of an entertainer or any member of his family.

Evening Calls.

In small communities, where it is customary to make formal evening calls after dinner, the usual hour is from nine to ten o'clock. In making an informal evening call, a lady may bring a gentleman with her, presenting him to her hostess, who will present him to her other guests.

The mistress of the house usually receives the visitors, being assisted by her husband or some other gentleman in the case of evening parties. The reception should be quiet, easy, and without over-ceremony. In some places it is customary to announce the names of guests as they enter the room. The host or hostess may then present them to other guests, if they are not already acquaintances.

When any one enters the room, whether announced or not, courtesy requires that the host or hostess shall rise at once, advance toward the visitor with words of welcoming, and request him or her to be seated. The seat offered should be one that seems most suitable to the age or sex of the visitor. If the master of the house receives the visitors, he will take a chair and place himself at a little distance from them; if, on the contrary, it is the mistress, and if she is intimate with the lady who visits her, she will place herself near her.

If several ladies come at once, we give the most honorable place to the one who, from age or other considerations, is most entitled to respect. If the visitor is a stranger, when the master or mistress of the house rises any person who may be already in the room should do the same, unless the company is a large one. When any of the company withdraw, the master or mistress of the house should conduct them as far as the door. But whoever the persons may be that depart, if we have other company we may dispense with conducting them farther than the door of the room.

If, upon entering a house where you wish to pay an evening call, you should find a small party assembled, it is best to present yourself precisely as though you had been invited. After a short while you may take your leave, explaining that you only intended to make a brief call.

Do not unduly prolong an evening visit. It is apt to become tiresome even to your most intimate friends, and, though they politely exert themselves to be agreeable, it does not argue that they are not wearied.

Should you find a lady on the point of going out when you make your call, make it as brief as possible, in order to leave her at liberty to carry out her plans.

When you have risen to go, do not delay your departure.

When you are prevented from attending a dinner party, or social gathering, call upon the person giving it without delay, and express your regret for your absence. In visiting a city where a friend resides, it is best to go to a hotel, although he may have invited you to make his house your home. You can afterwards call upon him, and should he then urge you to accept his hospitality, you can do so with propriety.

When asking guests to visit you in your home, whether in the country or city, it is proper to fix the date of their arrival and of their leaving, whether the length of their visit is to be two days or a fortnight. If the desired duration of a visit should not be specified in the invitation, a considerate person will take care not to extend it over a week, and a shorter time would be still better. It is courteous, in every case, to state to your host how long you expect to stay.

In case of a visit without invitation, you should always write to inform even a near relative or very intimate friend of your intended visit, and the time you expect to arrive.

Among the leading duties of the host or hostess may be named the following: See that everything has been prepared for the comfort of the guests. Anticipate their bodily wants as much as possible. Direct that some servant shall go to their rooms twice a day and ascertain whether anything is desired, and whether any assistance can be rendered. Arrange so that they can be provided with cold or warm baths, as they may prefer, every morning. See that coarse towels or bath-sheets are within their reach. Have a can of hot water taken to each room at the hours of dressing. A pitcher of iced water and a glass on a tray should be placed in the bedrooms at night.

Entertaining Guests.

Do not bore visitors by constantly trying to amuse them. After means of amusement have been provided, let it be optional with them as to whether they avail themselves of these or not. Permit your visitors to enjoy the liberty of solitude and quiet if they prefer. Any apparent effort to entertain is always bad form. The every-day life of a family should not be interfered with by the arrival of guests.

Visitors should conform as much as possible to the habits and customs of the household. They should be moderate in their demands for personal attendance. They should not carry their moods into the drawing-room or to the table, and, whether they are bored or not, should be ready to contribute as much as is in their power to make an atmosphere of pleasure. If the above involves too much self-sacrifice, then an invitation to visit should not be accepted.

In case a lady guest is expected, some gentleman of the family should meet her at the train, or other place of expected arrival, look after her baggage, and make all arrangements requisite to enable her to reach your house without delay or discomfort.

Bidding Guests Adieu.

While it is not wise to disarrange the regular routine of a household on account of the arrival of a guest, a reasonable time should be devoted to the entertainment of the visitor. Receptions, excursions, etc., may be provided for, the places of note in the vicinity shown, and pleasant acquaintences visited or invited to call. The guest, on departure, should be accompanied to cars or boat, and cordially taken leave of on the departure of the conveyance.

Ladies or gentlemen of true courtesy will treat with kindness or politeness the servants of the family visited, and may reasonably remember with some gratuity those by whom they have been served. Simple presents may also with propriety be made to the children of the family. Costly or lavish gifts, however, are not in order, and have the ill effect of placing your entertainers under an obligation for which they may not mentally thank you.

Do not outdress the members of the family in which you are a guest, especially in attending an entertainment or place of amusement with them.

Enter heartily into the plans that are made for your entertainment or amusement. You should never permit your host or hostess to feel that he or she has disappointed you while seeking to add to your enjoyment.

Upon returning home after a visit, write immediately to your host or hostess, announcing your safe arrival; and be careful to send kind messages to each member of the family, mentioning all by name.

Engraved or Printed Cards.

The extent to which the use of visiting cards is sometimes extended furnishes occasion to some, unused to polite society, to ridicule what they call "pasteboard politeness," and yet these paper representatives of our personality are exceedingly useful things; indespensible, indeed, to the full discharge of social obligations.

In the selection of cards several things are to be considered; style, size, color, and character of writing. As for color, it should always be pure white. The size and shape are regulated by the prevailing fashion, but any attempt at display, such as fancy designs, gilt borders, odd shapes, etc., are considered vulgar by well-bred people.

The most tasteful card is an engraved one. The printed card comes next, then the written card. The fashion as to letters changes, but a plain script or old English text, well engraved, is always neat and in good taste. In case the card is written, it should be done in pencil rather than in ink, thus suggesting that its use is a matter of accident.

The proper size for a gentleman is smaller and more oblong in shape than that ordinarily used by ladies. If he have no title, "Mr." should precede the name. A lady's card should have the word "Mrs." or "Miss" prefixed to her name. The eldest daughter of a family needs "Miss" only before the family name. The younger daughters need the christain names also.

The titles properly placed on cards are those of army and navy officers, physicians, judges, and ministers of the gospel, but neither militia nor any other complimentary titles are allowable.

Ladies now usually have the entire name—with the prefix of "Miss" or "Mrs." engraved on their cards, as "Mrs. John Morris Eames," "Miss Edith Lloyd Richardson."

Custom sanctions the engraving of the address on all visiting cards, and some ladies have the reception day engraved in the left-hand corner. In some cities there is one exception to this rule. A young lady, during her first winter in society, does not use a separate visiting card, but has her name engraved on the card of her mother or chaperon.

A single gentleman, if he prefers, can have his club address engraved on his card, instead of the number of his residence.

A widow can use on her cards either her own or her husband's name, as choice may dictate; though she has legally no right to retain the latter, custom sanctions it.

Husband and wife must have separate visiting cards. It is no longer the fashion to have the two names printed together, as formerly.

Rules for Leaving Cards.

In making the first call of the season, a lady leaves with her own, her husband's card, and also those of her sons and daughters. After a dinner party, or other special entertainment, a lady leaves her husband's card with her own.

A married lady, in calling upon another married lady, should leave one of her own cards and two of her husband's—one of the latter being for the wife and one for the husband. If the lady called on has a daughter in society, the visitor should leave two of her own cards and three of her husband's. If there be another lady in the house besides the hostess two cards each of wife and husband should be left. When calling on a mother and daughters, a lady should leave two cards.

When paying a first call to several ladies—not mother and daughters—a card should be left for each. When calling on the guest of a house, a card should be left for the hostess also, even if she is a stranger to the visitor.

When calling at a hotel, it is allowable, and even desirable, to write the name of the person for whom the visit is intended upon the card, to avoid the chance of mistakes;

but this should never be done at a private residence. Cards should be left or sent on the day of a reception, if illness, a death in the family, or any other cause prevents the acceptance of the invitation.

Cards should not be turned down at the corners, nor bent over at one end—the fashion is now out of date.

In sending a first invitation to a person on whom the hostess has never called, cards should be enclosed with the invitation; but, if possible, a call should precede a first invitation.

After a proper interval of time, cards of condolence may be acknowledged (by sending mourning cards inclosed in an envelope).

No lady should use on her cards a suggestion of her husband's profession or titles of honor, such as "Mrs. General Brown," "Mrs. Dr. Smith," etc. Nor should she be addressed in this manner in conversation.

In case a person is going away, and likely to be absent for a length of time, it is proper to write p. p. c. on his or her card, and mail the same to acquaintances. The letters thus used signify "*pour prendre congé*," which translated from the French means "to take leave." Some write the English words out in full. Upon returning home your friends must first call upon you.

If death occurs in any household where one is in the habit of visiting, it is proper to leave cards upon the family within a month after.

When a gentleman calls after receiving hospitality, he should leave cards for all the ladies of the family and one for the gentleman representing the head of the house, whether young or old.

When a lady is paying merely formal visits she need not necessarily ask whether the lady upon whom she is calling is at home, but can leave cards simply, unless she is under obligation for some courtesy, in which case she must ask whether the lady can receive her.

It is better to leave cards in the hall when entering an afternoon reception or tea, as the hostess might otherwise not remember your presence, and a card left in person would afterwards remind her that she was your debtor for a visit—for if you attend an afternoon reception it is equivalent to a call.

If you receive cards for a series of "at homes," and for some good reason cannot accept the invitation, send your card on the last day named.

A card left for you during your illness should be answered by a call as soon as your recovery will permit.

Should you send a card to a person who is ill, the bearer should always make a verbal inquiry as to your friend's condition of health.

In making calls upon an intimate friend it is not necessary to send your card in. The simple announcement of your name is sufficient. The use of a card always has an air of formality about it. Where persons are on cordial terms, and are visiting back and forth frequently, a card can very well be dispensed with.

V. BALLS AND EVENING PARTIES

It is in the evening party that society puts on its gayest aspect, and is on its best behavior. Here everything is regulated by a strict code of observance, any departure from which opens one to critical remark. It is necessary, therefore, that the etiquette of the ball-room should be fully understood by all who claim admission to society.

These entertainments always include dancing and a supper. If large, they are called balls; if small, simply dances or parties. Balls are of two kinds, public and private, but there is no essential difference between the etiquette required on the two occasions.

As regards the giving of private parties or balls, the rule is, that ball-goers should make one return during the season. In doing so, it is in good taste to restrict the number of invitations as far as social obligations will permit, that the guests may not be overcrowded, and the unpleasantness of the "crush" may be avoided. To gain this desirable end, however, it is always safe to make the invitations in excess of the number desired, as some are sure to fail to come. One-third more than the room will comfortably hold may usually be safely asked. And experience shows that more gentlemen than ladies should be invited, in order to secure an equal number of dancers of both sexes.

Invitations may be sent out from two to three weeks before the time fixed for the party. Less than two weeks is usually considered too short notice.

The hour for balls has, unfortunately, been made very late by the absolute dictum of fashion. Unless specially indicated on the invitation, a hostess cannot hope to assemble her guests before half-past ten, and in large cities the rooms are often not filled till an hour later.

Subscription Dances.

In most of the large cities several series of dances are arranged by certain leaders in the social world to which people are invited to subscribe. Each subscriber is usually entitled to a number of invitations for distribution, though in some instances the price of the subscription is small, and only permits one person to take advantage of each.

The subscription balls take place in some public ball-room, as a rule. In New York, for instance, at Delmonico's.

Several ladies are selected to form the reception committee, and they stand in one of the outer rooms, bowing to the guests as they enter. On such occasions, no one shakes hands; the ladies courtesy, and the gentlemen bow.

No unmarried lady should go to one of these balls, or to any large party, without a chaperon, and invitations should be sent to an elder member of her family, in order that she need not look outside for proper attendance.

In the West and South it is customary for gentlemen to take unmarried ladies to evening entertainments, but in the East, and in the best city society generally, such a thing would be considered the greatest breach of decorum. At a small dance in a private house a young lady may dispense with the services of a chaperon, if desired, but she should be escorted to and from the house by a servant or relative.

A good floor is essential to the enjoyment of dancing; when the carpet is taken up, care should be used that no roughness of surface is presented. Some ladies have their dancing-floors carefully polished with beeswax and a brush. A crumb-cloth or linen diaper, thoroughly well stretched over a carpet, is the next best thing to a polished floor.

The question of music is important. If it is a large ball, four musicians is the least number that should be engaged—piano, cornet or flute, violin, and violoncello. In small assemblies the violin and piano are sufficient, or, on occasion, the piano alone. In such a case a chance pianist should not be depended upon, but a professional one be engaged.

The orchestra should occupy what is considered the top of the room. In cases where it is not convenient to adhere to this rule, the end farthest from the door is usually chosen. The position of the orchestra needs to be considered by the dancers, so that, in quadrilles, their movements may be regulated thereby.

The Dressing Room.

A cloak-room for ladies must be provided, with maids to receive shawls and cloaks and to render such other assistance as may be required. It should contain several looking-glasses, and a supply of such articles as may be required in a lady's toilette.

A hat room for gentlemen must not be forgotten, with valets to wait upon them. It is best to provide checks for articles belonging to ladies and gentlemen left in charge of the attendants. Where checks cannot be had, tickets numbered in duplicate may be used—one being given to the lady or gentleman, and the other pinned to the coat or cloak. By this means the property of each guest is identified, and confusion at the time of departure is prevented.

Small fees of twenty-five or fifty cents are often given to servants in the dressing-room at a public ball, but never in private houses in this country, though the custom is common in England. Waiters should be on hand at supper to serve the meal, as the fashion of the gentlemen waiting upon the ladies is rapidly becoming obsolete.

In large cities, an awning should always be extended from the front door to the curbstone, on the occasion of a reception or other entertainment, as ladies do not like to step out of their carriages in light or elaborate dresses without some protection from the weather, and from the gaze of a curious crowd.

The Question of Toilette.

Ladies may wear as handsome dresses as they wish, and make their fullest display of jewelry. As everything about a ball-room should be light and attractive, it is in order for elderly ladies, who do not dance, to wear dresses more youthful in style and color than would be suitable for dinner, concert, or opera. For those who dance, silk dresses are, as a rule, objectionable.

Flowers are the proper ornaments for the head and dress. French ladies select them with reference to the season; but this is not insisted on in this country, and summer flowers may be worn at Christmas.

Ladies in deep mourning should not dance, even if they permit themselves to attend a ball. Should they do so, black and scarlet or violet is the proper wear. Where the mourning is sufficiently slight for dancing to be seemly, white, with mauve, violet or black trimmings, flounces, etc., is proper.

White gloves befit the ball-room; in mourning they may be sewn with black. They should be faultless as to fit, and never be removed from the hands in the ball-room.

The attire in which a gentleman can present himself in a ball-room is so rigorously defined, and admits of so little variety, that it can be described in a few words.

He must wear a black dress coat, black trousers, and a black waistcoat; a white necktie, white kid gloves, and patent leather boots. The waistcoat should be low, so as to disclose an ample shirt-front, fine and delicately plaited; it is better not embroidered, but small gold studs may be used with effect. Excess of jewelry is to be avoided. The necktie should be of a washing texture, not silk, and not set off with embroidery.

In the Ball-Room.

In a private ball or party, guests, on entering, should at once proceed to pay their respects to the lady of the house, who will remain near the door to greet them as they appear. Some of the gentlemen of the house should be near, to introduce to the lady any of their friends on their arrival. The daughters of the household are not required to assist in the ceremony of reception.

The fashion of carrying numerous bouquets to a ball is rapidly going out of existence, and many ladies refuse to take any flowers into a ball-room, the old custom having given rise to much vulgar rivalry and ostentatious display.

At public balls cards giving the order of dances are provided, on which gentlemen can write their names opposite the numbers of the dances for which they have been accepted by the lady holding the card. In England such cards are in general use, but they are rarely provided at private balls in this country.

From eighteen to twenty dances is a convenient number to arrange for, with supper as a suitable break at about the middle of the entertainment. A ball should begin with a march, followed in succession by a quadrille and a waltz. Then waltzes and quadrilles follow as may be arranged.

The cotillon or German, now so widely known, fills up the larger part of the evening, and begins, as a rule, immediately after supper. In a private house, the gentleman who has been invited to lead the German must ask the unmarried daughter of the family to dance with him, or the married daughter if so indicated as the family's choice. At the more general dances or large balls a young married lady is usually the one selected to dance with the leader.

It is quite the custom for a gentleman to engage a partner for the cotillon before the evening of the dance, and in this case, provided he can afford it, he usually sends her a bouquet of flowers. But should the lady request him *not* to remember her in this way her wishes should be respected.

Any gentleman, provided his acquaintance with the lady be sufficiently intimate to warrant him in doing so, has the privilege of sending her offerings of flowers whenever he cares to do so. In such a case he should go to a florist, leave an order for the kind of bouquet he wishes sent, and also his card in an envelope addressed to the lady, which envelope should accompany the flowers.

Formerly, at public balls a master of ceremonies was considered always necessary, but this official is no longer provided, the management being now entrusted to a committee of arrangements, who are distinguished by wearing ribbons in the buttonhole, or rosettes. The members of the committee superintend the dances, provide partners for those who need them, and introduce gentlemen to ladies with whom they desire to dance.

In private balls, the lady of the house or some member of the family attends to introductions, and when she has grown daughters they may employ themselves in arranging sets, introducing partners, and the like, desisting from dancing themselves while any of the lady guests remain unprovided with partners.

Requests to Dance.

The former fashion of saying, "May I have the pleasure of dancing with you?" has now given place to a less formal method, and a young man may accost a young lady with, "I hope you have kept a dance for me," "Won't you spare me a dance?" or "Shall we take a turn?" A young lady does not answer, "I shall be very happy," a reply which has disappeared with "May I have the pleasure?" but may say, "I am afraid I have none to spare except number ten, a quadrille," or "I am engaged for the next five dances; but I'll give you one, if you come for it a little later," or something similarly appropriate.

Another form of invitation is, "Are you engaged for this dance?" An unsophisticated girl may answer by saying, "I do not think I am," while perfectly aware that she is not, and the young men are quick to see through the evasion by which the maiden seeks to conceal her lack of partners. A clever girl will escape from the dilemma by such an answer, as "I am glad to say I am not," thus inferring that she might have been engaged had she desired, but preferred waiting for the chance of dancing with him—a suggestion flattering to the gentleman.

Ball-room small talk is not expected to rise above the common-place. The materials supplied by the entertainment itself are very limited—the band, the flowers, the floor, the supper. Dull people usually ring the changes on these themes. For instance, "How well the band plays!" "What a pleasant ball-room this is!" "Don't you think the floor slippery!" "How warm it is growing!", etc., etc. Such phrases, by incessant repetition, grow wearisome, and those who can master any more novel phrases should make an earnest effort to vary the monotony. Nothing very serious or profound is in place, but almost any one can escape from such trite subjects as these.

In the Dance.

When a lady has accepted an invitation to dance, the gentleman offers her his right arm, and leads her to her place on the floor.

A slight knowledge of the figure is sufficient to enable a gentleman to move through a quadrille, if he is easy and unembarrassed, and his manners are courteous; but to ask a lady to join you in a waltz, or other round dance, in which you are not proficient, is an offence not easily forgiven, as it may expose the lady to awkward embarassment.

It is inadvisable to dance in every set, as the exercise is unpleasantly heating and fatiguing. Never forget an engagement—it is an offence that does not admit of excuse, except when a lady commits it; and then a gentleman is bound to take her at her word without a murmur. It is quite probable, however, that he will remember it against her, and take care not to be again victimized by her.

At the end of a quadrille the gentleman should offer his right arm to the lady, and walk half round the room with her. He should inquire if she will take refreshments, and, if she replies in the affirmative, conduct her to the room devoted to that purpose. It is good taste on the part of the lady not to detain her cavalier here so long as to prevent him from fulfilling his next engagement, since he cannot return to the ball-room until she is ready to be escorted thither, and resigned to her chaperon or friends, or to the partner who claims her promise for the next dance.

Taking Supper.

The gentleman who dances with a lady in the last dance before supper, conducts her to the supper-room, attends on her while there, and escorts her back to the ballroom. At a private ball, the lady of the house may ask a gentleman to take a lady down to supper, and he is bound to comply, and to treat her with the politest attention.

In either case a gentleman will not sup with the ladies, but stand by and attend to them, permitting himself a glass of wine with them; but taking a subsequent opportunity to secure his own refreshment.

Refreshments must be provided for the guests during the evening; and, as nothing should be handed round in the ball-room, a refreshment-room is necessary. This should, if possible, be on the same floor as the ballroom, because it is not only inconvenient, but dangerous, for ladies heated by the dance to encounter the draught of the staircases.

In the refreshment-room, lemonade, tea and coffee, ices, biscuits, wafers, cakes and cracker bonbons should be provided. Some persons add wine to the list.

The supper table should be set in a separate room. It is usually opened to the guests about 12.30 o'clock, and may consist of hot and cold dishes, including oysters, bouillon, game, croquettes, filet of beef, salads, pates, ices, cakes, sweets, jellies, fruits, and champagne, punch, lemonade and mineral waters, or such combinations or variations of these viands as may be decided upon. Small tables are frequently used at balls, so that four or six people may sit at one table and eat their supper comfortably in courses.

In private parties the character of the supper will, of course, depend upon the taste and resources of those who give the ball. To order it in from a good caterer is the simplest plan, but may often prove too expensive. If provided at home, let it be done on a liberal, but not too profuse a scale.

After the Ball.

Assemblies of this kind should be left quietly. If the party is small, it is permissible to bow to the hostess; but at a large ball this is not necessary, unless you meet her on your way from the room. It is important to avoid making your departure felt as a suggestion for breaking up the party, it being very impolite to indicate by your movements or manner that, in your opinion, the entertainment has been kept up long enough.

Finally, let no gentleman presume on a ball-room introduction. It is given with a view to one dance only, and will certainly not warrant a gentleman in going further than asking a lady to dance a second time. Out of the ball-room such an introduction has no force whatever.

If those who have danced together meet next day in the street, or the park, the gentleman must not venture to bow, unless the lady chooses to favor him with some mark of her recognition. If he does, he must not expect any acknowledgment of his salutation.

After a private ball it is etiquette to call at the house during the following week.

VI. BREAKFAST, LUNCHEON AND TEA

The hour at which breakfast shall be served is governed entirely by the habits and tastes of the family. Where it is very late, it is often preceded by the sending of coffee or tea, rolls and eggs in some form, to the bed rooms, the family, in such a case, not coming down to a general meal till about noon. Breakfast, however, is served in the same manner whether the hour be early or late, and this meal should always be quite free from formality.

A tea and coffee tray should be placed in front of the mistress of the house. It is quite within the rules of breakfast etiquette for people to wait on themselves and to help each other, and as the bread, small dishes, etc., are frequently on the side table, this is a very convenient fashion. One servant is enough in the dining-room in the morning, even though a larger number may be retained.

Ordinary courses for breakfast consist of three or four, such as hominy or oatmeal first, then eggs, meat, or ham, and the chief portion of the food, followed by griddle-cakes and finally fruit. Toast should be freshly made, and sent up from time to time while the breakfast goes on. It should be always hot, as cold toast is never palatable.

Luncheon.

In imitation of the French, the meal which in our country is usually called "lunch" or "luncheon," is sometimes designated as "breakfast." It may either be formal, resembling a dinner, or informal, like the breakfast just described. It is served between 12.30 and 1.30, and the hostess may make it as simple or as elegant as she chooses. A formal luncheon party, however, differs little, if at all, from a dinner. If the occasion is a ceremonious one, the table is set in the same manner as for a dinner, and the dishes are handed by the servants; but the guests enter separately, instead of arm in arm.

At a large lunch-party either one long table, or several little ones, may be used. If the latter method is preferred, take care that the servants have ample room to pass between them. Each plate should have beside it two knives, two forks, one or two spoons, and a water-goblet.

The first course should consist of fruit or of raw oysters, or of bouillon or chicken consommé, served in cups set on plates, and provided with teaspoons.

This course is followed by an entree, chops with one or two vegetables, game or chicken, and salad, with sweets, candies, fruits, etc. Black coffee is usually served after luncheon.

In an informal lunch, if the hostess prefers, the sweets may be placed on the table in advance; but vegetables must be served from the side-board, and the chops, cold meats, etc., should be served by the hostess. Yet at such luncheons vegetables are frequently omitted, and in the selection of dishes the greatest latitude of choice is permissible. Among those most frequently served may be named oysters, croquettes, French chops, cold meats, beefsteak, fish, omelettes and salads.

At formal luncheons a bouquet for each lady is sometimes provided, they being grouped as an ornament in the centre of the table, and distributed after the meal. The custom is a pretty one, and worth encouraging. Occasionally, also, some pretty trifle is given to each guest as a memento of the occasion, but there is no obligation for this to be done.

Guests should be punctual in attendance on such an occasion, or send word promptly if prevented, by some sudden occurrence, from coming. Either a white or figured table-cloth may be used, but it must be one that will wash.

These are rules which etiquette and good breeding demand shall be observed, not alone at luncheon, but at all meals. The table is the social centre, and it is essential that those who gather around it shall conform themselves to the most approved rules of good society. A knowledge of table etiquette is very desirable to possess, since many regard it as one of the surest tests of good breeding. It is at the dinner table, however, that strict rules of observance become indispensible. There is much more freedom allowable at the earlier meals of the day, and a digest of table rules may be left till we come to speak of the principal meal.

It may be said, however, in regard to conversation at the lunch table, that both etiquette and good breeding forbid indulgence in gossip, particularly in any sense ill-natured, and nothing can be more ill-bred than to make, after the meal, carping criticisms on the hostess and the entertainment she has provided.

Teas and Afternoon Receptions.

These are among the most informal entertainments given, and the difference between a large afternoon tea and an afternoon reception is little more than the name, though the latter is perhaps a shade more formal. They frequently take place at the same hour, and the character of the invitations and entertainments differ very little.

The day and hour of an afternoon tea may be written on a visiting card. For an afternoon reception, an "At Home" card is used. No answer need be sent to such an invitation, unless one is particularly requested, which is not ordinarily the rule.

It is necessary to speak to the host and hostess immediately upon entering the room, but owing to the constantly moving crowd it is not essential that guests should again address the host and hostess when they are about to leave.

The length of stay can vary from five minutes to an hour at an afternoon reception, but at an evening reception the time is usually more extended.

Only simple refreshments should be served at an afternoon tea. Thin slices of bread and butter, sandwiches, fancy biscuit or cake, tea, coffee, or chocolate, ice cream, and bouillon are offered. Punch and lemonade—but no wine of any kind—may be added if desired; and also salted almonds, cakes, candies, and other dainty trifles. English breakfast tea is now preferred, served with cream and white sugar, or slices of lemon for those who like tea made in the Russian style.

At an afternoon reception the table may be supplied with oyster-salads, pates, boned turkey, ice-cream, coffee, and bonbons.

For a reception music is desirable, as it adds greater brilliancy to the entertainment.

The hostess should shake hands with her guests and receive them cordially; any formality is out of place on an informal occasion.

If the number of guests is small, the hostess should walk about the room, talking with her visitors; if large, she should remain near the door, and have the aid of other ladies, who should entertain the guests, ask them to take refreshments, and make introductions when necessary.

At a large and elegant afternoon reception the windows may be darkened, the gas lighted, and musicians employed, if the hostess desires.

What is known as a high tea is a meal taking the place of a dinner, at which hot meats, cakes, warm breads, preserves and other sweets are served. Such teas are more popular in the country than in town.

At the informal tea, of which it is the custom to partake at about five o'clock in many households, a tray is brought in to the mistress of the house, and placed before her on a small table. This tray should contain a tea-service, cups, saucers, etc. The lady herself makes the tea, pours it out, and passes it to the members of the family or the visitors who may chance to be present. The servant brings in thin slices of bread and butter, cake, and, perhaps, English muffins, which are usually served with the cup of tea at this hour.

Suppers.

Supper, as a rule, is similar to dinner, and unless served at a ball or as a part of some other entertainment has very much the character of that meal. After the theatre or opera, people frequently indulge in some refreshment which may or may not be dignified by the name of supper.

Picnics.

If one person gives a picnic he must provide everything, the modes of conveyance to the place selected, the refreshments, entertainment, etc., but if several join in this the labor and expense should be equally divided.

The refreshments should consist chiefly of cold dishes, such as meats, boned turkey, sandwiches, salads, cakes, jellies, pies, etc., with lemonade, or such other drinks as may seem desirable. Hot dishes are sometimes served, prepared at a neighboring house.

Picnics are often so arranged that each lady attending furnishes a dish of some kind. In this way all the refreshments can be provided without any difficulty.

Sometimes a wooden platform is erected, and dancing is the chief amusement after eating.

A picnic generally lasts from about noon until twilight, and the best season of the year for such an entertainment is when it is pleasant to be out of doors.

Sufficient china, glass, etc., should always be provided, though they should be of a plain and inexpensive kind, for fear of breakage.

Theatre Parties.

A dinner, either at home or at a restaurant, is frequently followed by a visit to the theatre or the opera. In such a case it is proper for the one who gives the theatre party to invite an equal number of ladies and gentlemen, a proper chaperon, of course, being provided. If the party are to dine together before going to the play, half-past six is usually the hour appointed, whether the dinner is to take place in a private house or in a restaurant. If there is to be no dinner, some house is selected where the guests assemble at a proper hour to reach the theatre in time.

It is customary, when you invite married people or gentlemen to the opera, to send them their tickets so that they may join you at the opera house, unless for some reason you wish to go with them. Unmarried ladies are usually asked to dine by their friends and go with them from their home. Suppers are rarely given after the opera, owing to the lateness of the hour. If the party did not dine together, however, it is customary for the host or hostess to give the guests a supper somewhere after the play.

It is the duty of the chaperon to see the unmarried ladies safely home.

Chaperons.

The word chaperon is French, and signifies a married lady, or one of sufficient age and dignity to accompany an unmarried one with propriety to any reputable entertainment.

Her services may be called upon, not alone for theatres, operas, concerts, balls, or other evening entertainments, but are demanded on many occasions during the day. No party of any kind which includes both sexes should be formed unless some married lady has charge of it.

The greatest courtesy and deference to a chaperon should always be manifested by the young ladies and gentlemen under her charge. Indifferent civility in this respect is the height of ill-breeding.

When an older lady passes a younger one in a ball-room and bows, the younger one should never remain seated when returning such a mark of recognition.

In leaving a room simultaneously, younger and unmarried ladies should always stand aside until the older or married ones have passed out.

The chaperon should behave with dignity, while being as genial and agreeable to the younger members of her party as possible. She should see that the unmarried ladies she has charge of reach home safely, and never leave them to a chance escort, no matter how tired she may be. One can never be too sure but that young girls may be exposed to unpleasant situations, if left without a companion of judgment and experience.

VII. BANQUETS AND DINNERS

The formal dinner is one of the most important occasions in social life, the test to which the degree of acquaintance of any one with the customs of good society is often put, the trial scene of good breeding and familiarity with polite observance. The rules to be observed at table are so many and minute that they require careful study, and many who pass muster on less formal occasions, may sadly err in some of the indispensible details of the etiquette of the table.

In ordinary, informal dinners, indeed, this strictness of observance is not demanded, and much more freedom is permissible, the home feeling here taking the place of ceremonious rules. Yet even here it is important to avoid falling into too great a latitude of action, since habits formed at home are very apt to accompany one abroad.

Choosing Guests.

In giving a dinner party, the first and often the most important question is, whom to invite. How many to invite follows as a problem of little less importance. For a pleasant dinner the number should be small rather than large, eight or ten being a fair average. An even number seems preferable, though this is not a matter of essential consideration.

Of course, large dinners are often a necessity, when given for business, family, or other reasons; and when display is the leading motive in giving the dinner, the number may be as great as the resources of the establishment will permit. But if comfort and the pleasure of social intercourse are the objects proposed, the number will need to be limited.

As to who should be invited, we have here a question that has sadly troubled many generations of hosts and hostesses. To bring together an incongruous mass of people is simply to invite failure. Guests should be selected with strict attention to a sense of fitness; and equal attention should be given to placing those of similar tastes together at table. The ease of conversation and the enjoyment of the dinner depend largely on this. Clever conversationalists are always most desirable guests. These are not always to be had, but even a single fluent talker often acts as a leaven that will rouse to speech a whole company of ordinarily quiet people. The invitation should be sent a week or two before the time fixed, or as much as three weeks if the affair is to be one of great formality.

Duties of the Hostess.

A dinner party is regarded by many persons as the most formal and, at the same time, the most elegant mode of entertaining guests—it is certainly the one which most severely taxes the resources of the hostess. Any woman not positively ill-bred can fill the position of hostess at a ball; but it requires tact, readiness, and a thorough knowledge of society to make a dinner party, in the ordinary parlance, "go off well." No matter how exquisite the china, glass, floral decorations, silver, and linen may be, if the hostess is a dull or awkward woman, the banquet will not be a success, for a proper selection of guests and the power of drawing them into gay and brilliant conversation are quite as needful as any of the material accessories.

The hostess should call into requisition all her tact and knowledge of society to set her guests at ease. No accident must disturb her. If her rarest china or most precious bit of glass is broken, she must appear not to notice it. If any one has had the misfortune to arrive late, she must welcome him or her cordially, though her duties to her other guests have not permitted her to wait in the drawing-room more than the fifteen minutes permitted by etiquette to the tardy. She must think only of encouraging the timid, inducing the taciturn to talk, and enabling all to contribute their best conversational powers to the general fund of entertainment. The same rules, of course, apply to the host.

The arrangements for dinner should be much the same whether the party be large or small, though, of course, the larger number will require a few extra servants, and may render advisable some extra courses. It should be remembered, however, by givers of dinners that too many courses are objectionable, and that in the best society of to-day fewer dishes are offered than was formerly the custom.

The hour for dinner should be fixed to suit the convenience of the guests and will vary in city and country. In the city it should be no earlier than seven nor later than eight o'clock, and the probability must be borne in mind that the guests will not all assemble till at least fifteen minutes after the hour named in the invitations. Tardiness of this kind was formerly considered rude, but has now become so common as to be expected and allowed for.

Arranging the Table.

In the centre of the table should be either a vase of flowers or a dish of fruit. Ferns make a very attractive effect. There should be small dishes of candies, figs, prunes, crystallized ginger, etc. Olives or radishes, salted almonds, etc., should be set in pretty little dishes on the table. These, with the silver, glass carafes of water, and wine decanters, complete the decoration of the table.

Everything else should be served from the side-table, and passed to each guest. This saves great confusion, and contributes more than anything else to the comfort of the meal. It is important also to have warm food served on hot plates. Cold plates will spoil the best dinner ever cooked.

The table cloth should be of the finest quality; and it is well for those whose means do not permit them to follow fashion's every caprice, to remember that fine white table linen is always in place. If colored materials are used, the latest edict of fashion forbids the employment of any stuffs that will not wash.

Decorations should always be arranged so that they will not prevent the guests from seeing one another. The preference is now for low dishes of flowers of delicate perfume. Those of strong fragrance should be avoided, as in a warm room their odor may become oppressive.

An ostentatious display of flowers, plate, or ornaments of any kind is not in the best taste; nothing being more vulgar than a seeming desire to impress your friends with a show of wealth.

Placing the Table-Ware.

On the right of the space left for the plate place two knives and a spoon. The present mode is to use silver knives as well as forks for fish, and in that case this knife is placed with the others. On the left three forks—that for sweets smaller than the others. At times other knives, forks, and spoons are provided, but it is better to bring these in as needed for the separate courses.

The glasses are placed on the right. These should be at least four in number. As it is a great breach of decorum, as well as a sign of ignorance, to drink one sort of wine from a glass intended for another, we shall describe the glasses commonly in use. The tall glass, or that with the shallow, saucer-like top, is for champagne; the green for hock, chablis and similar wines; the large, ample glass for claret and burgundy; the round, full-shaped glass for port, and the smaller glass for sherry.

It must not be understood, however, that wines are essential to a high-toned dinner. Some of our very best families, the acknowledged leaders of fashion, never put champagne or any other kind of wine on their tables.

Each guest must be provided with a table-napkin, which, in laying the table, should occupy the place reserved for the plate.

There are many different and various ingenious ways of treating the dinner-napkin. The simplest is to leave it in the folds in which it comes from the laundress.

Bread should be cut in thin slices, and laid on a napkin at the left of each plate.

The room may be lighted with either white or colored candles or lamp. Many persons prefer to have the light fall in part from side brackets or sconces on the wall.

Dress.

As regards dress for a dinner party, it must be governed in great measure by the character of the dinner, whether friendly and informal, or an occasion of leading importance and marked formality. For the latter, lady and gentleman alike should dress as elaborately as for a ball, though ball dress and dinner dress should by no means be the same. The occasions differ widely, and the fitness of things needs to be strictly observed.

As to the character of the lady's dress, that must depend on her own taste. It will suffice to state here that full dress is requisite and that jewelry may be freely worn. For an ordinary, small dinner, however, a much less elaborate toilette is sufficient, and may prove more comfortable.

The gentleman will wear the ordinary evening dress already described. He may wear more jewelry than is in good taste earlier in the day.

Entering the Dining Room.

If the dinner is to be a large and formal one, a gentleman should receive an envelope before entering the drawing-room in which is a card bearing the name of the lady he is desired to take in to dinner. If he does not know the lady he should ask the hostess to present him to her. At small and informal dinners this is not necessary, the hostess simply mentioning to the gentleman the name of the lady he is wished to escort to the table. In fact, though still in use, the custom above named is going out of fashion, an assignment in the drawing-room being considered sufficient.

A card is generally laid at each place giving the name of the guest who is to occupy it. This custom is also unnecessary at a small dinner. Menus, or bills of fare, are often placed before the guests at large dinners, but rarely at small ones.

When the guests have all arrived and the dinner is ready, the butler or waitress should enter the drawing-room and politely say to the lady of the house, "Dinner is served"; then he or she should return to the dining-room and stand behind the hostess until she is seated.

The gentleman of the house must offer his right arm to the lady who has been selected as the important guest of the evening, and then proceed to the table, placing her on his right, he generally taking the lower end of the table. The other guests follow, each gentleman with the lady selected for him; and finally the hostess enters with the gentleman whom she wishes to honor, he taking a seat at her right.

The remaining guests, in case their seats are not indicated by cards, will take the seats assigned to them by the host or hostess. In case no assignment is made, it should be remembered that questions of precedence, formerly so much considered, are growing to be of minor importance, particularly in this country.

Every place at a friend's table is equally a place of honor, and should be equally agreeable, so that, in the best circles, it is becoming the custom for the guests to sit in the order in which they enter the room. A little care should, however, be taken that a judicious distribution of the guests, according to their tastes, accomplishments, terms of intimacy, etc., is secured. Ladies sit on the right of gentlemen.

As soon as seated all the guests remove their gloves, and, taking the napkins from the table, open them and spread them on their knees. The napkin is not to be tucked into the waistcoat or pinned on to the front of the dress. It will usually contain a roll; that is placed on the left side of the plate.

The Dinner.

It is not easy to lay down any fixed rule for the character of the dinner. That must be governed by the season and the taste and resources of the host. However humble the pretensions of the dinner, it should never consist of less than three courses, namely, soup or fish, a joint (which, in a small dinner, may be accompanied by poultry or game) and pastry. Cheese with salad follows as a matter of course. Dessert succeeds.

The number of servants necessary will depend, of course, on the number of guests. Three will be enough for a party of ten or twelve persons. On their training and efficient service the success of the dinner will largely depend.

What is above said about courses applies, of course, to a very simple meal. In those of more pretension the courses may vary considerably in number and character, though custom lays down certain fixed rules for the succession of viands. For an ordinary dinner the following will suffice as an example.

Dinner Courses.

The dinner may begin with oysters on the half shell, five or six for each person. If not the season for oysters, small clams are frequently served in the same way. These should be very cold, and the clams are better if surrounded by cracked ice. A piece of lemon should be in the centre of each plate, and pepper and salt be passed with this course.

Soup follows. Either one or two may be served—a white and a clear, or a white and a brown soup; but never serve two kinds one after the other.

Follow the soup with fish. At the best tables you will find a silver fish-knife as well as fork; if not, eat with a fork in the right hand and a small piece of bread in the left.

When there are two kinds of fish, the larger one—say the turbot—is placed before the host; the lady taking that which is less calculated to fatigue in the helping. When fish sauce is handed, put it on the side of your plate. There are certain sauces appropriate to each kind of fish—as lobster sauce with turbot, shrimp or caper with salmon, oyster with cod, and so on.

The *entrees* follow, being ordinarily served in covered silver side-dishes. They consist of sweetbreads, *pates*, cutlets, and made-dishes generally. It is not customary to do more than taste one or two of these. Too much attention to them is apt to unfit one for enjoying the rest of the dinner. In eating of these dishes the fork alone, where possible, should be used.

The meats and vegetables follow. Some vegetables, such as asparagus, sweet corn, or maccaroni, can be offered by themselves; but hostesses should beware of making the meal tiresome by a needless number of courses.

It is not allowable, however, to serve more than two vegetables with one course, nor to offer anything except potatoes or potato salad with the fish.

The roast meats are placed about the table in this way: The largest and most important, say haunch of venison, before the host; one before the lady of the house, and such dishes as tongue or ham before particular guests, who occupy seats at points where carving-knives and forks are placed in readiness.

Carving is an important accomplishment, and one that every gentleman should seek to acquire. A man should be able to carve a joint or a bird easily and dexterously, but facility can only be acquired by practice, which it is important to have. It is customary, however, to have the joint carved off the table, put back as before carving, and served.

It is hardly necessary to say that knife and fork are used in the eating of meat, poultry, or game; and it seems equally unnecessary to say that the purpose of the knife is simply to cut the food. Under no circumstances must it be used to convey it to the mouth. Vegetables are eaten with a fork. A spoon is rarely necessary, and a knife comes into use only in such cases as cutting off the heads of asparagus and the like.

If considered desirable, a course of vegetables may follow that of meat,—asparagus, cauliflower, artichokes, baked tomatoes, or some similar dish being served.

Game follows. Salad may be served either with the game or as a separate course. In the latter case serve with it cheese and bread and butter. The bread can be cut very thin and carefully buttered, or the butter and bread can be served separately. If preferred, the cheese can be served as a separate course.

Follow the cheese and salad with the sweet dishes and ices, then serve the fruit, and lastly the bonbons. Coffee may be served in the drawing-room, when the courses have not occupied too much time, or at the table, according to the preference of the hostess.

Black coffee, which should be made very strong and clear, must be served in very small cups, with tiny coffee-spoons.

After the Courses.

Everything except the lights and ornaments should be removed from the table before the dessert is served, the crumbs being brushed off with a crumb-scraper or a napkin, a clean one of course.

Finger bowls, set on handsome china or glass plates, with a fruit napkin or embroidered doily between, should be placed on the table for the fruit course. The dainty embroidered doilies, however, must never be used, and substantial fruit napkins should be supplied when any fruits that stain badly are served.

Where there is more than one servant, a second waiter carrying the proper vegetables should follow the first, who passes the meat or fish. The lady next the host should first be helped, and the others in turn, after which the gentlemen should be served. But when there is only one servant, the guests may be helped in the order in which they sit, beginning with the lady at the host's right, then passing to the one at his left, leaving the host himself to be served last.

When the servants have placed the dessert on the table and have handed the fruit and sweets once round, they retire. Any further service which the ladies may require can be given by the gentlemen, who will, of course, exert themselves to see that their neighbors are properly attended to.

Retiring from the Table.

Then the hostess bows to the lady of most distinction present, and all the ladies rise and prepare to retire. The gentleman nearest the door opens it, and holds it open for them. The hostess is the last to go out. While they are going all the gentlemen rise, and remain standing until they are gone. It would not, however, be a violation of etiquette for the gentlemen to accompany the ladies to the drawing-room at once, and what is here said applies principally to formal dinners, and to families in which the gentlemen are accustomed to conclude the meal with cigars and wine.

Tea and coffee are dispensed by the lady of the house in the drawing-room. This is her special province. It should be accompanied by a few wafers; a plate of very thin rolled bread-and-butter and a few biscuits of the lightest description may be added. One cup of tea or coffee only should be taken; and certainly no one can need to be told that it must not be poured into the saucer to cool. It will be handed round the room by the servants.

In the drawing-room there should be a little music to give relief to the conversation.

At a plain family dinner, at which one or two guests are present, more devolves on the host and hostess, and less on the servants.

General Hints.

You should sit at a convenient distance from the table, and sit upright. Do not lean back, or tilt your chair, or stoop forward towards the table.

When grace is said at the table, observe the most respectful attention, reverently inclining the head.

Do not be impatient to be served. Should you need anything at the hands of the servants, do not order them to serve you, but request them politely, in a low, distinct tone, adding, "if you please." In declining a viand offered by them, say, "Not any, I thank you," etc.

Do not hesitate to take the last piece of bread or cake in a dish handed to you. Your host has more for other guests. When a plate containing food is handed to you, set it down before you, and do not pass it to your neighbor.

Wines.

As regards the use of wines at dinner, the following rules will suffice. They should be served in the following succession.

First.—Sherry, which must be very cold and decantered. This to be passed with the soup. If a white wine is to be served, it should be given with the oysters and also very cold. This must not be decantered.

Second.—Champagne, which should be packed in ice several hours before it is to be used. Serve it in the bottle with a napkin held round it to absorb the moisture. Champagne is passed with the meat.

Third.—Claret, which must be decantered and warm, and served with the game and salad.

Fourth.—Madeira, also decantered but of its natural temperature and passed with the dessert.

Mineral waters, such as apollinaris, can be passed at dinner, as some prefer a mineral to natural water. As has been already said, a glass suitable for each variety of wine is placed on the table. This is not the case with the Madeira glasses, which are kept on a side-table, and brought to the table after the glasses previously used have been removed and before sweets are served.

After dinner, when the ladies have left the room and the gentlemen are preparing to smoke, coffee, without milk, is served and carried to the ladies in whichever room they may be.

It may be said in conclusion that the custom of wine drinking during dinner, and of drinking and smoking afterwards, is no longer of so ordinary application as formerly. While still generally retained in the case of large and formal dinners, it is frequently omitted in small, and commonly in family dinners, being considered by many a custom "better kept in the breach than the observance."

Dinners at Restaurants.

When a dinner is given at a public restaurant, a table can be reserved in the public dining-room, or a private room can be engaged. It is usual to order the dinner beforehand, so that there will be no needless delay in serving it when the guests arrive.

If a lady gives the dinner it is better for the guests to meet at her house, so that they may all go together to the restaurant, but if an unmarried gentleman is the host he must appoint an hour for the party to meet him in the vestibule of the restaurant, and the lady who has consented to *chaperon* his dinner must be there very punctually, in order to spare any unmarried lady the annoyance of arriving alone at a public place.

The style of the dinner must rest with the taste of the host or hostess, but it should resemble as nearly as possible a dinner in a private house, both in table appointments, variety of dishes, service, etc.

It is perfectly admissible for an unmarried lady to dine at a restaurant, provided that she is properly *chaperoned*.

Lunches and breakfasts are, under the above circumstances, governed by the same rules as those given in regard to dinners.

Ladies may lunch or breakfast without gentlemen in respectable public restaurants, but two ladies should if possible be together, rather than that one should lunch or breakfast alone.

Of course, no one needs to imagine that in entertaining a few friends at dinner all this ceremony is indispensible. It belongs to occasions where formality and close attention to fixed social rules are considered necessary, but there is an agreeable form of informal dinner which calls for no manual of observance, in which the friends are taken into the bosom of the family and the ease of unfettered home intercourse prevails. For such dinners there are no set rules; every community, every family, make their own laws, and calmly ignore or simply laugh at the dictates of fashion. Here soup may be omitted, if not cared for; you may pass up your plate to your host for a slice of beef; you may do a dozen things that are quite out of order where formality prevails, and be as heedless and happy as you please. But all this is behind closed doors; when you fall under fashion's eagle eye no such looseness is for a moment to be considered; you must eat and drink to rule and measure or consider yourself a candidate for banishment.

VIII. COURTSHIP AND MARRIAGE

Preceding the marriage comes the courtship, an event which, since the world began, has been one of vital interest to man and woman, but which is so varied in its incidents and characteristics that no set rules of etiquette can be made to apply to it. It may suffice to say that when a gentleman feels such admiration for a lady as to induce him to make a proposal of marriage to her, it is the more manly and courageous way to do so verbally instead of in writing. During courtship anything that offends good taste, or is conspicuous in the conduct of a betrothed pair, should be sedulously avoided,—such as making public each other's sentiments. These concern the pair alone; they lack interest for the public at large, and etiquette demands that they should be kept secret.

A sufficient public announcement of the engagement is made by the ring, which it is usual for the gentleman to give the lady, as a token of the new relation existing between them. This may be a diamond solitaire, if the means of the gentleman will permit. Otherwise, a plain gold band is in order. It must be worn on the third finger of the left hand.

When the engagement is once formally made, it may be made known by the young lady or her mother to relatives and intimate friends. Good form, however, requires that the gentleman should gain the consent of the guardian or parents of the lady before making his proposal to herself. This is particularly important if he is in moderate circumstances and she wealthy.

The length of the engagement must depend largely upon the wishes of the parties most particularly concerned. Of late years it has become the fashion to shorten the time, and unless the marriage is likely to take place within six months it is better to make no public announcement of the engagement.

Hasty marriages, on short acquaintance, are in all cases to be avoided. The loving pair should grow to know each other well and intimately before courtship is allowed to pass its preliminary stage of attractive acquaintance; and many an unhappy marriage has come from undue haste in this particular, ardent fancy being permitted to take the place of cool reflection and growing knowledge.

There is a delight in courtship, moreover, which is often unwisely abridged by too quick a marriage. In the words of one wise maiden, who was asked why she did not marry when she had so many lovers, "Being courted is too great a luxury to be spoiled by marrying." But all this is matter for which it is useless to attempt to lay down rules. Men and maidens have followed their own inclinations in regard to the length of the period of courtship since civilization began, and will probably continue to do so.

It is only when the engagement has been made and formally announced that etiquette can have anything to do with the matter. A couple once betrothed, and the betrothal made public, have placed themselves, in a measure, in the hands of society, and must yield in some degree to social obligations, if they wish to avoid invidious comment.

Wedding Preliminaries.

After the wedding day is fixed the happy couple are especially obliged to conform to the rules of etiquette, there being fixed laws laid down for every detail of the subsequent ceremonies. One thing should be borne in mind, that the wedding belongs to the family of the bride. It is their affair to send the invitations, provide the music, the decorations, the wedding breakfast, etc.; the duties of the groom being restricted to providing the certificate, naming the clergyman, and a few others. The announcement of the engagement is generally followed by a dinner given by the parents of the bride, to which some of the relatives of both families are invited. Subsequent dinners are apt to be given by relatives and intimate friends of the engaged couple.

The gentleman's parents, relatives, or friends call as speedily as possible upon the young lady and her parents or guardians. The selection of the wedding day is usually left to the choice of the bride-elect and her mother, and to their taste are similarly left such details of the occasion as the arrangement for the wedding, the character of the trousseau, or bridal outfit, the breakfast or reception, the choice of bridesmaids, the style of the ceremony, etc.

Any time of the year may be regarded as suitable for a wedding to take place, though certain periods, such as Easter week, are often preferred. In Europe there is a strange prejudice against the month of May. As regards the day of the week, Wednesday or Thursday are apt to be selected; while Friday is looked upon as unlucky. In this country Friday holds the same doubtful position, but any other day of the week, and any month of the year, are quite in order.

Marriage is regulated in this country by the laws of the State, a license being required in some States, and not in others. This the intending husband should procure, he being accompanied by the father, guardian, or near relative of the lady, that the requisite information required by the law may be given.

The bridal trousseau does not include plate, china, furniture, or any household ware, but is restricted to the bride's attire, of which sufficient is usually provided to last during the first few years of wedded life. Too great a quantity of wearing apparel is to be avoided, whatever the wealth of the bride or her family, since the rapid changes in fashion are likely to make some of it useless before it can be worn. The extent and character of the trousseau, of course, must be governed by the means and taste of the bride and her family.

Bridal Gifts.

The custom of presenting gifts to the bride has grown until it has become much of a burden and something of a farce, from the absolute uselessness of many of the articles sent and the annoying duplication that is likely to take place. In every case the presents should be in accordance with the means and probable style of living of the recipients, and as far as possible in harmony with their tastes and surroundings. Nothing is more ill-advised than to send some gorgeous ornament for a plain, simply furnished house. Simple, tasteful selections, however, are rarely out of place, and there is a wide choice of articles which every family can use. The variety is endless, ranging from the costliest silver and jewels, clocks, lamps, fans, odd bits of furniture, camel's hair shawls, etc., down to a pretty vase, a bit of embroidery, a picture, or a piece of china painted by the hand of a friend. No one should hesitate to send a present whose money value is small, such gifts are often the most welcome, and a present which owes its existence to the donor's own labor is regarded as especially flattering.

Gifts are usually packed where they are bought, and sent directly from the shop to the bride's house. They should be sent during the week preceding the wedding, and not less than two days before the event. It is so customary to make an exhibition of the presents on the day of the wedding or the preceding day, that it is very necessary that they should arrive in good time.

The display of the wedding presents is a point to be decided according to the bride's wishes. Some people think it ostentatious, others devote much time and care to their arrangement, and it is undoubtedly gratifying to many to be permitted to see them.

One rule, however, is *invariable*—the bride must acknowledge every gift by a personal note. It must be borne in mind that the gifts are hers, her own private property, which she can claim from the hands of the sheriff, if misfortune supervenes, and leave by will to whom she elects. Of course, gifts may be sent specially intended for the groom.

If people do not know what to send, or what the young couple require, they should take some means to discover, for nothing is more annoying than to receive duplicate presents. It is not uncommon for soup-ladles, butter-knives, tea-urns, and other articles of table use or house-ornament to be given so profusely that the young couple are almost as well fixed to set up a store as to begin housekeeping.

It is customary for the gentleman to make his bride a present of jewelry to be worn at her wedding, where his means will permit him to do so. If a wealthy man, he often presents the bridesmaids with a souvenir of the occasion, a fan, bracelet, ring, or bouquet. He buys the wedding ring and furnishes the bride's bouquet; but there his privilege or duty ends. The bride's family supply the cards, carriages, and wedding entertainment.

Flowers.

The bride's bouquet should be composed exclusively of white flowers, such as gardenias, white azaleas, or camellias, with a little orange blossom intertwined. It is the privilege of the groomsman to procure and present this to the bride.

It is generally considered a delicate attention on the part of the bridegroom to present a bouquet to his future mother-in-law. This may be composed of choice variously colored flowers, whilst those of the bridesmaids should be white, with an edging of pale blush roses. These also are presented by the groom.

To save trouble and anxiety with regard to bouquets, it is the best plan to order them from some practical florist. He will know exactly what to send, and will deliver them fresh on the day of the marriage.

The Bridesmaids.

The bridesmaids are usually selected from among the sisters of the bride, or her cousins or friends. The head-bridesmaid is ordinarily her most intimate friend. Occasionally the sisters of the bridegroom assist as bridesmaids, but the bride's own sisters should always be given the preference.

The number of the bridesmaids, of course, must be governed by circumstances. Six is a usual number, though more are frequently selected. An even number must always be chosen.

The dress of the bridemaids is usually of some light white material. They frequently wear wreaths and veils, but of a lighter and less costly character than those of the bride. Bonnets are often worn instead of veils. It is desirable for them all to be dressed as nearly alike as possible.

In this country the bridesmaids either provide their own dresses or may accept them from the bride.

The Groomsmen.

The number of groomsmen must correspond to that of the bridesmaids. These gentlemen have little to do, with the exception of the first or principal groomsman, who is charged by the bridegroom with the management of the whole affair, and should be furnished by him with money to pay all the expenses. He is usually his brother or most intimate friend.

Where a ring is used he should take charge of it, and present it to the bridegroom at the proper moment. He must hand the minister his fee, and pay the sexton and other persons entitled to payment their legitimate charges.

It is his duty to undertake all the arrangements for his friend on the eventful day, and to see that they are properly carried out.

The dress of the groomsmen should be similar to that of the bridegroom, the dress worn being that suitable to the hour of the day, in the same fashion as for any other entertainment. They should be dressed as nearly alike as possible.

The Bride.

After the wedding invitations are issued the bride does not ordinarily appear in public. On the morning of the wedding day she usually breakfasts in her own room, and remains there till the hour arrives to dress for the ceremony. It is the privilege of the bridesmaids to perform this service.

The bride's costume is, as a rule, of white, either silk or satin, or of material in accordance with the means of the parties. A bridal veil of lace or of tulle is usually worn. The gloves, of course, should be white, and the shoes of white kid or white satin. It is customary for the bride to make some slight presents to the bridemaids on the morning of the marriage. These should be simple, it being borne in mind that the gift is merely to serve as a memento of the occasion, and that no article of much value is demanded.

After dressing, the bride remains in her room until the carriage is announced, or the time has arrived to descend to the drawing room if it is to be a home wedding. The bride's carriage is the last to leave the house. It should contain but one occupant besides herself—her father, or the person selected to give her away at the altar.

The Ceremony.

The ushers are selected by the gentleman, though the lady is generally consulted in the choice. Six is the number ordinarily chosen, and their duties are to show people to seats in the church, and to present the guests to the bride and groom at the wedding reception. They, and the groomsmen as well, should all wear *boutonnières*, or button-hole bouquets, made of some handsome white flowers.

The bridal procession is formed by the ushers, who walk first two and two, followed by the bridesmaids, also two and two; then the child-bridesmaids, if this pretty custom is adopted, and then the bride, leaning on her father's right arm. Sometimes the children lead the others. At the altar the ushers separate, moving to the right and left, the bridesmaids do the same, thus leaving room for the bridal pair.

Upon the entrance of the bridal party within the doors of the church, the organist will play a "Wedding March," and as they take their places at the altar will change this to some low, subdued, but sweet and appropriate melody, which he should continue with taste and feeling throughout the service. As the bridal party leave the church, the music should be loud and jubilant.

The front pews in the church should be reserved for the families and especial friends of the happy pair. These are generally separated from the others by a white ribbon drawn across the aisle.

The wedding party should stand according to the positions decided upon by the wishes of the bride and groom. Usually the bride takes her place upon the left of the groom, her father stands a little in advance of the rest, behind the couple, and her mother just in the rear of her father. The bridesmaids group themselves on the left of the bride, the groomsmen on the right of the bridegroom, all in the rear of the principals.

The clergyman, who should be already in his place, at once begins the marriage ceremony.

When a ring is used, to avoid the long delay of drawing off the glove, brides now cut the finger of the one on the left hand, so that it can be slipped aside to allow the putting on of the ring; this is the routine almost invariably followed at church weddings.

The responses of the bride and bridegroom to the clergyman should be given clearly and distinctly, but not in too loud a tone. On the conclusion of the ceremony the newly-married couple and their attendants withdraw in much the same manner as on advancing, the bride now taking her husband's left arm.

The Wedding Breakfast.

The English fashion of a wedding-breakfast is now often followed in this country, the guests being specially invited a fortnight in advance. On such an occasion the gentlemen, on reaching the house, leave their hats in the hall; but the ladies do not remove their bonnets.

In going to the table, the bride and groom precede, then the bride's father with the groom's mother, the groom's father with the bride's mother, the best man with the first bridesmaid, the other bridesmaids with gentlemen selected as their escorts, and finally the remaining guests. The dishes usually provided are bouillon, salad, birds, oysters, ices, jellies, etc.

The health of the bride and groom is proposed, usually by the groom's father, and response is made by the father of the bride. The health of the bridesmaids may also be proposed; but the occasion is ordinarily more pleasurable if strict formality is dispensed with.

After remaining for an hour or two with the guests, the bride retires to change her wedding dress for a traveling costume. She is met by the groom in the hall, the necessary good wishes and kisses are exchanged, and the pair drive away, often followed by a shower of rice and slippers.

As regards the desideratum of wedding cake, it is no longer the fashion to send it; but small boxes of it, neatly tied with white ribbon, are prepared, of which each guest may take one upon leaving the house, if desired.

What is above said relates to the marriage of a maiden. In the case of the marriage of a widow certain changes in dress and ceremony are requisite. A widow must never be attended by bridesmaids, nor must she wear a veil or orange blossoms; the proper dress at church is a colored silk and bonnet, pearl gray or some other delicate shade being preferable, though she is privileged to wear white if she desires. She should be accompanied by her father, brother, or some near friend.

A House Wedding.

A fashionable wedding at home calls into requisition the services of both florist and caterer; the former to decorate the rooms, the latter to furnish the marriage feast. A variety of floral devices may be employed, from the marriage bell and monogram to a bower of ferns large enough to receive the bride and bridegroom.

The part of the room to be occupied by the bridal party should be marked off by a white ribbon. After the clergyman has taken his place, the bride and groom enter together, followed by the mother, father, and other friends. Hassocks should be ready for the bridal pair to kneel upon, in case this is deemed necessary as a part of the ceremony.

Where money is lacking to defray the charges of florist and caterer, or in country localities where their assistance cannot be had, the loving hands of friends may decorate the rooms with foliage and blossoms, and the table be supplied with simple dishes such as the household means can furnish. Wedding-cake, light cakes, ices, and coffee arranged on a table prettily ornamented with flowers is a sufficient entertainment at a quiet home-wedding, and, let it be added, is in far better taste than a more ostentatious display which is beyond the means of the family, and leaves a burden of debt behind.

In fashionable circles, after the return of the bridal party the members of both families give a dinner in their honor, and the bridesmaids, if able to do so, give them some entertainment.

Brides sometimes announce, when sending out their wedding-cards, two or more reception days; but they do not wear their wedding-dresses, though their toilettes may be as handsome as they desire. When invited to balls or dinners, however, the wedding-dress is perfectly appropriate for a bride to wear—of course without the wreath and veil.

Sending Cards.

In some circles the young couple send out cards with their wedding invitations, stating the day and hour they will receive callers after their return from their wedding tour. No one who has not received such a card should call upon a newly married couple. Such cards should be as simple and unostentatious as possible. Where they are sent out, the wedding journey must be terminated in time to allow the new couple to be at home at the time indicated for the reception of their visitors.

Visitors should call punctually at the time appointed. In some places it is customary to offer the guests wedding-cake and wine. The mother, sister, or some intimate friend of the bride must assist her in receiving these calls. This rule is imperative.

IX. FUNERAL ETIQUETTE.

The great sorrow brought upon a family by the death of one of its members often renders the immediate relatives incapable of properly attending to the arrangements necessary for the funeral. The services of a near friend or a relative, therefore, are often availed of, he being informed of the wishes of the family, and relieving them of all further care, by himself taking charge of everything needing to be attended to.

The ladies of the family, before the funeral, see none except intimate friends, and may with propriety deny themselves even to those.

Immediately after a death the relatives and intimate friends of the deceased should receive some notification of it. An undertaker must also at once be summoned, and the arrangements and details of the funeral be left to him. Notices should be inserted in one or more of the daily papers of the time and place of the funeral services, etc.

In some parts of the country it is customary to send notes of invitation to the funeral to the friends of the deceased and of the family. These invitations should be printed, neatly and simply, on mourning paper, with envelopes to match, and should be delivered by a private messenger, where convenient.

A written notification, however, is frequently sent where only a few are to be specially invited, the newspaper announcement being trusted to inform those less closely connected.

The expense of a funeral should be in accordance with the means of the family. It is a foolish form of pride and ostentation that induces the members of a family to load themselves unnecessarily with debt in order to make a showy funeral display. All marks of respect should be shown to the dead, but undue expense is more indicative of a desire on the part of the living to impress their friends and neighbors than a genuine desire to do honor to the one who has passed away.

Where invitations are sent out, a list of persons invited must be given to the person in charge of the funeral, in order that he may provide a sufficient number of carriages. Those invited should not permit anything but an important duty to prevent their attendance.

The House Services.

When the funeral is at the house, some near relative or intimate friend should act as usher, and show the company to their seats.

A decorous silence should be preserved in the chamber of death, no one speaking except in low, subdued tones. The members of the family are not obliged to recognize their acquaintances. The latter show their sympathy by their presence and considerate silence.

The coffin, if in good taste, will never be unduly elaborate or over ornamented. A black cloth casket, with plain silver mountings, is preferable to any other.

The clergyman usually stands in a position as nearly as possible midway between the family and assembled friends, so that his words may be heard by all. The family remain seated together, usually in some room upstairs, and never appear until it becomes necessary to enter the carriages. If the funeral be in church, they occupy the front pews, the intimate friends sitting immediately behind them.

Six or eight of the most intimate male friends of the person who has died are invited by the family to act as pall-bearers. On the day of the funeral they assemble at the house, and the undertaker provides each of them with black gloves and a mourner's scarf. They walk with their heads uncovered beside the coffin, up the aisle, if the services be held in church, and also escort the body to the grave. They usually sit in one of the front pews, reserved for their use, while the funeral services are being conducted.

Flowers.

With regard to sending flowers, the wishes of the family should be considered. If you are uncertain upon this point, it is safe to send them. They should be simple and tasteful, also in keeping with the age of the person who has been removed by death.

As the sending of elaborate floral designs has been much overdone of recent years, it is becoming frequently the custom not to send flowers to houses of mourning, and in many funeral notices a request is made to this effect. Whatever flowers are received are usually placed upon the coffin during the services, and afterwards carried to the cemetery to be laid on or a few laid in the grave.

In preparing the body for the grave, the usual custom is to dress it in the garments worn in life; but young people are frequently laid out in white robes.

It is optional with the ladies of the family to attend the remains to the last resting place or not, as they may prefer. And of recent years the invitation is generally to the house only, notification being given that the funeral will be private. This is a judicious innovation, in the direction of economy and the avoidance of ostentatious display, and it is one that is likely to grow among people of taste and judgment.

After the funeral, only the members of the family return to the house, except in the case of friends or relatives from distant cities, and a widow or mother may properly refuse to see any others than her nearest relatives for several weeks.

Mourning.

The length of time for wearing mourning has greatly decreased during the past five years, as formerly there was such an exaggeration of this that sometimes the young people in a family were kept in constant black, owing to the death of successive relatives.

For deep mourning, black stuff dresses, heavily trimmed with black crape, and long crape veils, are worn. During the second period the crape is left off, and plain black alone is used; and for half-mourning light black, black silks, black and white, or costumes of mauve or grey, can be worn.

For gentlemen, at first plain black cheviot suits, with broad crape bands on their hats, and black gloves. For the second period they cease to wear black clothes, varying these by dark suits of black and grey, and the width of the crape hat-band is narrowed. For half-mourning the black hat-band is the one emblem of grief retained.

A widow should wear deep mourning for twelve months, plain black for the second year, and half-mourning for six months.

For parent, brother, or sister, the usual time of wearing mourning is one year; for a young child, six months; for an infant, three months.

There is much difference of opinion in regard to the wearing of mourning dresses, many objecting to doing so for what they consider excellent reasons. In truth, the mourning attire aids to keep up the feeling of grief, and to depress where some means of enlivening the feelings is desirable. Yet it serves as a protection to those whose deep sense of loss induces them to avoid many social duties, and who would escape from thoughtless and painful allusions. It is a matter, in short, that must be governed by the feelings and sentiments of those directly concerned.

During the first period of mourning it is not considered becoming to visit places of amusement or to enter social life or indulge in gaiety of any kind. After a certain time elapses—six months or a year, according to the depth of the mourning—a person is at liberty to go out quietly to concerts, theatres, informal dinners, etc.

It is customary to send a few words of sympathy to the family after a death has taken place. Such letters should be brief and written with real interest and affection, otherwise they had better be omitted.

During a period of mourning, note paper and visiting cards are usually edged with a black border, the width of this to be determined by the depth and recency of the mourning. The *very* wide band is exaggerated, ostentatious, and in bad form.

No invitations of any kind should be left at a house of mourning, until after a lapse of a month or more, according to circumstances. Then, cards to balls, weddings, and general entertainments may properly be sent. When persons who have worn black are ready to resume their social life, they should leave cards with all their friends and acquaintances, either in person or by sending them through the mail.

X. ANNIVERSARY AND OTHER OCCASIONS

Among the festivities which society provides for its enjoyment, that of the anniversary wedding has of late years come greatly into vogue. It is a pleasant custom, and has been gradually extended until numerous anniversaries of the wedding day, differently named, are celebrated with appropriate ceremonies. Beginning with the silver and golden wedding, on respectively the twenty-fifth and the fiftieth anniversaries, there have been gradually added various others, such as the wooden wedding on the fifth, the tin wedding on the tenth, the crystal wedding on the fifteenth, the linen or china wedding on the twentieth, and, as an occasion of exceedingly rare occurance, the diamond wedding on the seventy-fifth anniversary of the marriage.

This is not the whole list, much ingenuity having been exercised in adding to the frequency and diversity of these anniversaries, and to those named may be added the iron wedding, celebrated after one year of married life; the paper wedding, on the second anniversary; the leather, on the third; the straw, on the fourth; the wooden, on the seventh; the ivory, on the thirtieth; the coral, on the thirty-fifth; the woolen, on the fortieth; and the bronze, on the forty-fifth. It is now a common custom, however, to overlook all the anniversaries preceding the silver wedding.

Gifts and Invitations.

A leading feature on these occasions is the sending of gifts, which are expected to be made of the material which gives the name to the wedding, and much ingenuity is exercised in selecting or inventing suitable presents, those of an amusing kind being often a leading feature.

Invitations to any of these occasions should be appropriate in design. For instance, the straw wedding cards may be printed on straw-colored stationery, the ivory wedding cards on ivory, and the bronze wedding cards in a similar way. For the silver wedding the cards may be printed in letters of silver, and in golden letters for the golden anniversary.

An appropriate form of invitation, say for a silver wedding, will be as follows:

1870. MR. AND MRS. BROWN 1895.
Request the pleasure of your company,
On Monday, June the Ninth,
At eight o'clock P.M.,
SILVER WEDDING.
WILLIAM BROWN. SUSAN CAMPBELL.

Many persons omit the names at the end, and in some cases an exact copy of the marriage notice, taken from the newspapers of the wedding period, is made to serve the purpose. A second form is here appended:

1850. 1900.
MR. AND MRS. HENRY WILSON,
At Home,
May fourth, 1900,
at eight o'clock P.M.,
GOLDEN WEDDING.

The entertainment may be similar to that supplied at any reception, with the addition of a large wedding-cake, containing a ring, which the bride cuts just as she did twenty-five years before.

As to character of the gifts, there is abundant scope for selection, with the general remembrance that they should be in consonance with the name of the anniversary. In the case of a wooden wedding, for instance, there is an opportunity for the bestowal of beautiful gifts in wood-carving, handsome pieces of furniture and picture frames, as well as the regulation wooden rollers, chopping trays, etc., for the kitchen. Bits of birch-bark are frequently used for the invitations.

Tin weddings have become occasions of special liveliness, and much ingenuity is exercised in devising amusing gifts. One young wife received from her father-in-law a check, marked "tin," enclosed in an elaborate tin pocket-book. The tin utensils used in the kitchen and household furnish an abundant variety for choice. Tin funnels holding bouquets of flowers and tied with ribbons are usually numerous, and the glittering metal, adorned with bows of ribbon of every hue, is very effective when displayed on a table. The invitation is usually printed on a bit of tin.

On the fifteenth anniversary, or crystal wedding, the invitations are frequently crystalized, while the gifts may embrace every variety of glassware. The linen wedding is more rarely celebrated, many persons considering it unlucky. The Scotch have a superstition that if any allusion is made to this anniversary, one or other of the married couple will die within the year.

The silver wedding is usually a joyous occasion. The bride and groom are still in the prime of life, their children are of the age for a full enjoyment of festivity, and their circle of friends is likely to be complete.

Those who receive invitations usually send some present composed of silver, which may be as trivial or as costly as the donor chooses. They are generally marked "Silver Wedding," or bear some appropriate motto with the initials of the couple enclosed in a true lover's knot. The variety of articles is almost endless,—silver clocks, photograph frames, belt-clasps, mirrors, brushes and combs, and other toilet articles set in solid silver, and the long array of table-ware.

The golden wedding is a much less frequent occasion, and far less likely to be a joyous one. Age has crept upon the principals, and is creeping upon their children and friends, life has grown sober, and its pathway is apt to be strewn with many sombre memories.

As articles of gold are apt to be more expensive than many of those invited care to give, flowers are frequently made to do duty in their place—preferably yellow ones. As for the diamond wedding, the seventy-fifth anniversary, it is so rare an occasion that no description of it is necessary. Of course, it calls for presents of jewelry, though, as in the case of the golden wedding, guests may replace them with something less expensive and more appropriate to the age of the married pair.

Christenings.

Another occasion incident to married life, is the christening, which next demands consideration at our hands.

When children are to be christened at home, it is rapidly becoming the custom to celebrate such events by giving some sort of a social entertainment, the size or arrangement of which depends upon the taste and circumstances of the parents. If many are to be present, the invitations should be sent out formally, as though for an afternoon reception. The usual hours selected are from 4 until 6 P.M. Upon a small table a silver or china bowl should be placed, which is used as a font. Flowers in abundance are never in bad taste at a christening.

After the clergyman has performed the baptism, a beverage called "caudle" is served in cups to the guests.

Recipe for making Caudle.—This should be made of fine, smooth oatmeal gruel, flavored with wine or rum, lemon peel or nutmeg, and sugar added according to taste. Of course, in the case of a church christening no house-entertainment is called for, and a family party is all that is likely to come together.

Private Theatricals.

The private theatrical provides an entertainment which is daily growing in popularity both in England and our own country. Sometimes a stage is erected in a private house, but more frequently small theatres are engaged, where the performance takes place.

Instruction, or "coaching," is as a rule given to the amateur performers by some professional manager, actor, or actress engaged for the occasion, and is essential if any satisfactory entertainment is hoped for. Rehearsals are equally necessary and must be frequent to insure success.

For tableaux it is better to have the advice and taste of some clever artist, as the beauty and interest of the human pictures depend so largely upon the posing and drapery of the figures, to say nothing of the effect of the lights and the choice of colors.

Entertainments of these kinds may take a considerable variety of forms, and are very pleasant breaks in the monotony of party giving and the other set affairs of ordinary life. The time spent in preparation, however, is likely to be considerable, and the result is often more farcical than the performers intend or understand.

Etiquette for General Occasions.

There are, or should be, rules of etiquette applicable to every situation, the home circle, the street, the store, the traveling conveyance, and in short for all the occasions in which men and women are brought together. These consist mainly in observing the ordinary requisites of politeness, the avoidance of rude or selfish behavior, and of any actions likely to hurt the feelings or offend the tastes of those with whom chance or social relations bring us into contact. It is not sufficient for the demands of society that we are morally correct; correctness in deportment is no less important, and there are numbers of small observances required from any one who wishes to keep on the correct side of the line which divides good manners from ignorant or boorish behavior.

Etiquette of the Household.

First among these requisites comes the etiquette of the home circle, in which the principle of politeness and courtesy are often laid aside as a consequence of careless habits and selfish egotism. Good manners are too often a cloak which is flung aside like a needless burden as soon as the home threshold is crossed, yet there is no place where kindness and thoughtfulness should be considered as more important, and in which neglect of the small courtesies of life are so likely to wound or distress.

Certainly the true gentleman or lady will endeavor to be as courteous and considerate in the family circle as among strangers, and equally avoid impatient and cutting remarks or lack of polite attention. Some few remarks on the rules of propriety for the home will not come amiss.

The house should be kept in as good order for the comfort of the family as when strangers are expected, and the members of the household should be careful to act in drawing-room or at table as if a guest were present. Formality, indeed, is not called for, but ease of manner does not imply rudeness, and politeness should never be laid aside.

Only a few leading suggestions can be here given. These will suggest others to all who attend to them. First, it is important to make special efforts to be punctual at meal time. Nothing interferes with the regular movements of the household, or disturbs the equanimity of the hostess, more than carelessness or irregularity in this respect. To have to keep food warm for the late comer, or perhaps to cook it afresh, is a needless waste of time and labor, and is apt to add to the household expenses.

Do not fail to rise and offer a chair on the entrance of an older person, or at all events an infirm person, to the room in which you are seated, and never precede an older person in entering or leaving a room, or in ascending stairs. Do not permit children to occupy the pleasantest seats, to the deprivation of their elders, or to be annoyingly intrusive when older persons are engaged in conversation. The "children's hour" should not be permitted to encroach upon that of their elders. Never enter any person's room without knocking.

Be careful to give any one who desires to read full access to the light. Avoid making unnecessary noise on coming home late at night, and in this way disturbing the repose of the household. Gentlemen who are in the habit of smoking at home should confine their devotions of the cigar to a single room, and avoid careless distribution of ashes or matches on floors or tables.

If callers are likely to drop in to meals, it is advisable to have a seat at the table reserved; and a room should also be set aside, where possible, for chance visiting friends. In every case a welcome should be ready, and every indication of being discommoded be sedulously avoided.

As regards the intercourse of the immediate members of the household, it will suffice to say that, while formality can well be laid aside, politeness and courtesy should never be forgotten.

Table Manners.

In conclusion a few rules of importance in table manners, familiar to most, but too often carelessly ignored, may be given. The napkin should be spread over the knees, not fastened at the neck or tucked into a button hole. It should be folded after using, if the hostess folds hers.

The fork should be held in the palm of the left hand. If in the right, it should be used with the prongs upward, and held between fingers and thumb.

Avoid bending over the plate, drooping the head too low, thrusting the elbows out, or sitting with the back turned toward the person in the next chair.

Be careful not to take large mouthfuls nor to eat too hastily or heartily.

Never hesitate to take the last piece of bread that may be offered. A refusal to do so would be a reflection upon the hostess, suggesting that she had not provided fully for her guests.

In regard to rarer dishes, however, it is wise to show no inclination for more, if the supply on the table seems small.

Never play with napkin ring, fork, or other article, and keep the hands off the table when not employed. Never leave the table till the meal is over, and avoid reading newspapers, books, etc., at table unless alone.

Never use a spoon to eat vegetables. A fork is the proper thing. Never take butter from the dish with your own knife, or use it except on your own plate. It is scarcely necessary again to give warning against putting the knife in the mouth. Yet this unpardonable breach of table etiquette is often committed by persons whose training should have taught them better.

The table should be a centre of cheerful and enlivening conversation, and too close attention to the duty of eating should be avoided, alike from reasons having to do with healthy digestion, and the desirability of every one striving to bear a part in the entertainment of the family circle. The table is the one place where all the family meet at leisure, and where they should seek to make themselves agreeable.

Etiquette of the Street.

Courtesy requires the return of all civil greetings—those of servants included. Only the most serious causes can justify "a cut."

In bowing, the head should be bent; a mere lowering of the eye-lids, affected by some people, is rude. Etiquette does not permit a familiar nod, except between business men or very intimate friends. In passing and repassing on a public promenade or drive, bows need to be exchanged only at the first meeting. In carrying canes, umbrellas, and packages, care should be taken not to discommode passers with them. This is particularly needed in the case of raised umbrellas, which are often carried with careless disregard of the convenience of others. This is one annoying way in which selfishness is shown.

At a street crossing it is the duty of gentlemen to make way for ladies, and younger for older persons. In walking or driving, the rule to keep to the right will enable all to avoid danger of collision.

A gentleman should always offer his arm to a lady in the evening. In the day this is only in order in case of the pavement being slippery, there being a crowd, or the lady being old or needing support. If there are two ladies, he should offer his arm to one, and let the other walk beside her.

In the Electric Car.

If a gentleman desires to offer his seat to a lady, he should not beckon to her, but rise and offer it to her courteously. It is the duty of the lady, in accepting the seat, to acknowledge his courteous attention by a bow and an audible expression of thanks. On the other hand it is an indication of ill-breeding to show signs of displeasure if, on entering a crowded car, no seat is offered. It should be borne in mind that the gentleman has a right to his seat, and is under no obligation, except that of politeness, to give it up, and weariness or weakness may render it inadvisable for him to rise. No lady, if young or strong, will expect or permit an old gentleman to relinquish to her his seat. If, however, a lady is ill or greatly fatigued she should not hesitate to request a seat, giving her reasons for doing so. No gentleman, and few who are not gentlemen, would refuse such a request.

No gentleman will take a vacant seat while ladies are standing, and none should stand on the car platform in such a manner as to discommode alighting passengers. It is easy and courteous to move aside, and step down into the street if necessary. If baskets or bundles are brought into the car care should be taken not to let them annoy passengers.

Etiquette of Business.

Never forget that time is precious to some persons, though you may be ready to waste it; also that money is necessary, and that it is every one's duty to settle all debts as promptly as possible.

Never fail to have all the details of an agreement decided so far as they can be before the transaction is concluded, and bear in mind that a contract can be broken only by the consent of all the parties concerned.

Never keep washer-women, seamstresses, nor any one dependent upon daily labor waiting for payment, and, on the other hand, when requesting payment of a debt, avoid any unpleasantness of tone or manner.

Never buy on credit, if cash can be had. This is a rule of common sense and practical economy.

Never forget that a character for fair dealing is a capital that cannot be lost. Do not think it unnecessary to learn the minutest details of any business, nor imagine that success in any business can be attained without a thorough training for it.

Never fail to be courteous in all business intercourse; a pleasant manner will do much to insure success.

Never insist on entering any business office, if told that its occupant is not at leisure. Courtesy requires that you should quietly await his leisure, or offer to call again if time will not permit you to wait.

Etiquette of the Club.

Doubtless, while there are few members of clubs who do not have a sufficient knowledge of the rules of etiquette governing them, some may desire information on certain points, and it is for the benefit of the latter that the following brief directions are given:

All members should become familiar with the regulations, and rigidly obey them.

You have a full right to vote against the admission to a small social club of any one whose society is not agreeable to you. It would destroy the pleasure of such a club if all its members were not congenial. Yet you should not allow personal prejudice to influence you in voting upon the admission of a new member of a large club. Is the gentleman's record clear, and is he in all respects a worthy associate for gentlemen? This is the only question to be asked.

Never persistently propose for membership of a small club a name that has been refused. Avoid any conduct likely to be disagreeable or disobliging to fellow-members. A gentleman should be as courteous in a club-house as he would be in his own.

Do not talk loudly in reading-rooms or library, and never misuse books, newspapers, nor other club property.

It is selfish and impolite to monopolize the best arm-chair, to make a practice of dining early to secure an extra share of a favorite dish, or to require special attention from waiters to the discomfort of other guests.

Avoid showing anger in political or religious discussions, or making a personal matter of an argument. Do not seek to force your opinions on others against their will.

Never mention the names of ladies in the club, or show idle curiosity about other members.

Never send an employee out of the club-house on any private errand without first requesting permission of the clerk or superintendent.

If the guest of a club, do not take the liberty of introducing any one else; but the guest of a club is expected to avail himself of all the privileges of its members.

When a gentleman is admitted to the privileges of a club through the courtesy of a member, he is expected, when his temporary membership ceases, to pay any debts he may have incurred, for if he omits to do this his club-host is obliged to settle his account for him.

Etiquette of Traveling.

Ladies should wear neat traveling dresses of suitable material and simple style, display as little jewelry as possible, and carry the smallest amount of baggage by hand. It is important to have the initials or full name on all trunks.

Never attract attention by loud talking or laughing, and, if under the escort of a gentleman, do not annoy him with needless requests. Always repay a gentleman any traveling expenses, no matter how trivial.

A lady when traveling alone, should, if possible, arrange to be met at the station by some friend. In arriving at a station in a large city where she is a stranger, she should avoid taking a hack, choosing instead horse-cars, or the stages plying between stations.

While always acknowledging with thanks any courtesy offered, young ladies should avoid entering into unnecessary conversation with or accepting favors from men who are strangers.

Older ladies are privileged to offer advice or assistance, should occasion require, to young ladies traveling alone.

It is courteous for a gentleman to offer to buy tickets, and check the baggage of a lady who is traveling under his care; but he should first take her to the ladies' waiting room, not leave her standing on a crowded platform. He may also offer to get her refreshments, newspapers, or books, and—if the journey is a long one—invite her to walk up and down the platform at the stations. If, by any accident, the friends expected fail to meet a lady at the station, the gentleman escorting her should, if possible, go with her to her destination.

A gentleman may offer to help a lady, even if she is a stranger, whenever she seems really in need of aid. For instance, if she is laden with many parcels, or has several children with her who must be transferred from boat to car, or station to station.

Two gentlemen, strangers to each other, may talk together if agreeable to both; but it is wise to discuss only general topics.

Gentlemen may offer to open or shut a window for ladies; but should never presume upon a chance civility thus extended, by attempting to use it as a means of entering into conversation with them. While not regarded by all persons as obligatory, it is always courteous for a gentleman to offer his seat to a lady who is standing in any public conveyance.

No gentleman should smoke in cars or other places when ladies are present, spit on the floors in cars or stations, be disobliging in a smoking-car by refusing to change his seat to accommodate a party who may desire to play some game, or accept a light, or any trifling civility, from a fellow passenger, without any expression of thanks.

Before entering boat, train, or car, give the passengers who are in the act of leaving time to get off. Before taking a seat just vacated wait a sufficient time to see if its former occupant intends to return.

It is ill-bred to complain about the trivial discomforts that fall to every traveler's lot, and make uncomplimentary comparisons between one's own home and the place where one happens to be.

Never occupy more than one seat in crowded conveyances, and if you have placed a parcel on a empty seat, cheerfully remove it whenever it is needed. Do not take the seat beside any person in a steam-car without asking if it is engaged.

Never incommode fellow-travelers by opening a window which forces them to sit in a draught—it may be an affair of life and death to delicate persons.

Table Etiquette for Children.

It may not be out of place to add here a few good old rules for children's behavior at table which can safely be followed:

Give the child a seat that shall be strictly its own.

Teach it to take its seat quietly.

To use its napkin properly.

To wait patiently to be served.

To answer promptly.

To say "thank you."

If asked to leave the table for a forgotten article, or for any purpose, to do so at once.

Never to interrupt and never to contradict.

Never to make remarks about the food.

Teach the child to keep his plate in order.

Not to handle the bread nor to drop food on the cloth and floor.

To always say "excuse me, please," to the mother when at home, and to the lady or hostess when visiting, if leaving the table before the rest of the party.

To fold its napkin and to put back its chair or push it close to the table before leaving.

And after leaving the table not to return.

Children who observe every one of these rules are well-behaved, delightful companions, and owe it to their mothers's careful training.

XI. FORMS OF INVITATIONS

XI. Forms of Invitations.

In issuing invitations for any occasion, they should be sent out as nearly as possible together, and in ample season. If they be for a large reception, dinner, or similar entertainment it is best to send them a week or two in advance; and for a ball, in the height of the season, two or three weeks. No one should be invited at the last moment, except it be an intimate friend, who can be trusted to excuse lack of ceremony.

For large or formal occasions, such as dinners, balls and receptions, use plain cards, or note-paper, engraved in plain script. If the invitations be written, small white note-paper, of the best quality, should be used, and the writing done carefully, with proper attention to the arrangement of words.

Invitations to Parties.

The following will serve as a correct form for a note of invitation to a private party:

Mrs. William H. Johnson
requests the pleasure of
Mr. and Mrs. James Browns' company
On Thursday evening, April eighth,
from nine to twelve o'clock.

As an example of a suitable reply we give the following:

Mr. and Mrs. James Brown have much pleasure in accepting Mrs. William H. Johnson's kind invitation for Thursday evening, April eighth.

Or, if circumstances render it necessary to decline, the cause of declination should be courteously stated, as follows:

Mr. and Mrs. James Brown regret that a previous engagement to dine with Mrs. Rowland deprives them of the pleasure of accepting Mrs. William Johnson's kind invitation for Thursday evening, April eighth.

The reasons for declining may be very varied, but should be distinctly stated. "A previous engagement" has often to do duty in this case.

A prompt reply must invariably be made by all who recognize the obligations of courtesy, and it may be well to give one or two examples of an uncivil manner of replying, into which well-meaning persons sometimes fall through ignorance or carelessness:

Mr. and Mrs. Brown regret that they cannot accept Mrs. William H. Johnson's invitation for Friday evening.

A still ruder form is: *Mr. and Mrs. Brown decline Mrs. Johnson's invitation for Friday evening.*

It needs little knowledge of the laws of etiquette, however, to teach people not to commit such glaring incivilities as the latter.

A simple form of invitation to an evening party is the following:

Thursday, May seventh.

Mrs. —— requests the pleasure of Mr. ——'s company at an Evening Party, Thursday, May twenty-eighth.

An answer will oblige.

Dancing. [Music, or any special attraction].

The answer, which should be returned within a day or two, may be similarly brief:

Mr. —— has much pleasure in accepting Mrs. ——'s polite invitation for Thursday evening, the twenty-eighth.

Saturday, May ninth.

Short or verbal invitations should never be given, even among relations and intimate friends. These are discourteous, as implying that the persons invited are of no importance.

Dinner Invitations.

Dinner invitations are written or engraved in the name of both husband and wife:

Mr. and Mrs. Henry Wilson
request the pleasure of
Mr. and Mrs. Samuel Clayton's company at dinner
November eighth, at seven o'clock.

An acceptance should be worded as follows:

Mr. and Mrs. Samuel Clayton
accept, with pleasure,
Mr. and Mrs. Henry Wilson's kind
invitation to dine with them,
on Monday, November eighth, at seven o'clock.

An invitation to dinner, once accepted, should be held as little less than a sacred obligation. Only disabling sickness or other extreme necessity should be permitted to stand in the way of its being kept; and then, if time permits, immediate notice, with reason for same, should be given. A dinner party is carefully arranged for a set number, and one or more empty chairs are sure to disturb the completeness of the occasion, and cause heartburnings to host and hostess. A late invitation to fill the gap is usually sent, with proper explanation, to some friend who may be depended upon to overlook the informality.

Invitations should be issued in the name of the hostess, except those to weddings and dinner parties.

R. S. V. P., the initials of the French phrase "*Respondez, s'il vous plait,*" or "Please reply," may be written in the right-hand lower corner of an invitation if an answer is particularly needed. Its use, however, is becoming less frequent, since it tacitly implies that the recipient needs a reminder. In a dinner invitation it is especially unnecessary, since nothing can be more discourteous than to fail in an immediate answer. The day and hour named should be repeated in the answer, to avoid possible misunderstanding. If guests are asked to meet a distinguished gentleman, or lady, this should be mentioned in the card of invitation, directly after the hour of dinner; for instance:

At seven o'clock, to meet
Mr. John P. Wallace,
of London.

Or an extra card may be inserted with the regular invitation, saying, "to meet Mr.—," etc.

Here is an example of an invitation to a reception specially designed for this purpose:

Mr. and Mrs. Thomas F. Jackson
request the honor of your presence
on
Tuesday evening, November fifteenth,
from eight until eleven o'clock,
to meet the
Rev. Professor Patton
of the
University of Pennsylvania,
R. S. V. P. *119 Locust Avenue.*

Invitations to large entertainments, receptions, etc., may be sent to persons in mourning if the bereavement has not occurred within a month; but etiquette permits them to refuse without assigning a reason, sending, however, on the day of the entertainment, black-bordered visiting-cards, which announce the cause of their absence. Invitations to dinners and luncheons should never be given to persons in recent affliction.

Always direct an answer to an invitation to the person or persons who issue it, even though they may be strangers to you. Always answer an invitation to dinner or luncheon at *once*, accepting or refusing positively. The reason is obvious; the number of seats being limited, a prompt reply gives the entertainer an opportunity to supply your place. Should illness, a death in the family, or any other reason prevent the keeping of a dinner engagement, a letter or telegram should be immediately sent, stating the fact. All invitations, in fact, should be answered with as little delay as possible.

When issuing invitations to a family, direct one to the husband and wife, one to the daughters, and one to the sons. The daughters' names may be placed after the parents on the same card, but not the sons.

Notes of invitation to a gentleman should be addressed Mr. A. B. Cohen, *never* A. B. Cohen, Esq. Gentlemen must never be invited without their wives, nor ladies without their husbands, unless to entertainments given exclusively to gentlemen or to ladies.

Small Entertainments.

Visiting-cards must not be used either to accept invitations or to regret the necessity of declining them, though invitations to small entertainments may with propriety be written on a lady's visiting-card.

A less formal mode of invitation to an evening reception may be the following:

MRS. SMITH,
At Home,
Tuesday, May ninth, at nine o'clock, 849 Green Street.

If dancing, music, or other entertainment is provided, it can be mentioned in a word at the bottom of the invitation.

We append below an invitation to a musical and card party, with acceptance of same:

Hilton, January 1, 1902.

DEAR MRS. NUTTALL:

We purpose having a small party for music and cards next Thursday, and hope that you, your husband, and the dear girls will join us. If you can favor us with your company, please ask the young ladies to bring their violins and music, and do not be later than eight o'clock.

We unite in kindest love to you all.

Believe me, most affectionately yours,
Lois Markley.

ACCEPTING.

MY DEAR MRS. MARKLEY:

We shall have much pleasure in accepting your kind invitation for Thursday next. Edith desires me to give you her love, and to say that she is delighted at the prospect of a musical evening; she will bring all your favorite selections, and do her best to play them. With our united regards, believe me,

yours affectionately,
SUSANA NUTTALL.

"The Willows,"
January twelfth, 1902.

Where there are several sisters in a family, addressed on an invitation as "The Misses ——," it is usually understood that not more than two of them will avail themselves of the invitation.

Invitations for any general entertainment sent to a country house where guests are stopping, are, as a rule, addressed to "Mr. and Mrs. ——, and party," this invitation being expected to include the sons and daughters of the family as well as the visitors.

Form of English Invitations.

The following is the style often used in England for invitations to garden parties, etc.:

MR. AND MRS. JONES
request the pleasure of
MR. AND MRS. ROBINSON'S
company at a garden party on Tuesday, June ninth, at four o'clock.
Collation at seven o'clock.
Dancing 8 to 11.
10 Corson Place. *R. S. V. P.*

For afternoon teas, etc., the visiting-card of the hostess, with simply "Tea at four o'clock," and the date in the left-hand corner, is all that is necessary, or possibly "At home from four until seven."

Wedding Invitations.

Invitations to marriage ceremonies are issued in the name of the bride's parents, or, if both are dead, in the name of a near relative or guardian. Paper without crest or monogram is considered the best to use so far as good taste is concerned. The accepted form is as follows:

MR. AND MRS. ROBINSON
request the pleasure (or honor) of your company
at the marriage of their daughter
MARY BURD
to
MR. JAMES HOWARD WILSON,
at St. James' Church, on Tuesday, June tenth,
at twelve o'clock.

Separate cards are sent if the wedding ceremony is to be followed by a reception at the parents' residence, the formula used being "Mr. and Mrs. Smith at home, etc."

To avoid confusion at the church a small card is sometimes enclosed with the invitation, on which the name of the church and the hour for the ceremony are printed. Such cards must be presented at the door, in order that, to avoid a crowd, only such friends as have received invitations to the wedding may be comfortably seated.

In case no reception is given, and the newly-married couple wish to announce to their friends their new abode, a card in the following form may accompany the invitation:

AT HOME
Tuesdays in May.
489 Green Street
Philadelphia.

In the case of house weddings, or when recent bereavements demand that the wedding shall be private, it is now customary to invite intimate friends by written invitations, and send simple announcements of the event to those not expected to be present. In such cases the stationery used should be of the same quality and style as for the invitations. The announcement may read as follows:

Mr. and Mrs. Harvey Wellington
Announce the Marriage
of their Daughter
Catharine
to
Mr. James Howard,
Saturday, September ninth.
Philadelphia,
1902.

An invitation to an anniversary wedding may be couched in the following form. If no presents are desired, the invitation should explicitly say so, otherwise it will be taken for granted that they will be acceptable:

1877 *1902*
Mr. and Mrs. Andrew Lewis
request your presence
at the
Twenty-fifth Anniversary of their Wedding
Wednesday Evening, March eighth,
194 Lombard Avenue,
New York.
No presents.

General Invitations.

In addition to the forms of invitation to more or less formal occasions above given, notes inviting to various informal meetings may take forms familiar or the reverse, in accordance with the degree of intimacy of the parties. A few forms will suffice as examples:

New York, June 8, 1902.

My dear Mr. Wilson:

A few of us are arranging for an excursion to Bolton Springs on the 15th inst. We should be very glad to have you as one of the party. We shall be three days absent from town. If you can make it convenient to accompany us, we are sure you can count on an enjoyable time. Be kind enough to let me know within a day or two, and believe me

Sincerely yours,
A. B.

10 Brown Street,
New York, December 18, 1901.

Dear Mr. Wilson:

Can you make it convenient to run over to New York on Christmas day, and drop in on our small family party? You can count on a hearty welcome, and a fair allowance of the enjoyments of the season.

Yours very truly,
Henry Smith.

As examples of more familiar notes of invitation, between intimate friends, the following will suffice:

Dear Harry:

Some of us are expecting to spend a few hours jovially, next Wednesday evening with a glass of wine and a cigar as enliveners. I hope you will make one of the party, and shall hold a chair for you.

Yours as ever
Will.

Dear John:

Our old friend Harvey Wilson has just got home from his Western trip. I have asked him and his cousin James to take a chop with me to-morrow at six p. m., and want you as a good fourth. Don't fail me. You know what a good fellow Wilson is.

Yours faithfully,
H. P. Jones.

My Dear Mary:

A few friends will be with us on Friday evening, the 8th inst., to share a social cup of tea and have an hour's chat. Can we count on the pleasure of your company?

J. S. White.

My Dear Jennie:

Your kind request is at hand. I shall be glad to accept it, and hope to enjoy both the tea and the chat.

Yours cordially,
Mary Moore.

My Dear Sir:

We start next Tuesday for the Catskills, by private conveyance. There is room for one more in our carriage, and we should be glad to have you fill the vacant space. I trust no inconvenient engagement will hinder your acceptance.

Yours socially,
William Black.

Mr. S. D. Henderson.

Invitation to a Carriage Ride.

Hillsdale, Ohio, October 3, 1901.

My dear Miss Barry:

In these bracing Autumn days, when the foliage is so beautiful, I am sure you will enjoy a ride for an hour or more. It will give me great pleasure to have your company for a ride on Saturday afternoon next, and I hope you will have no previous engagement at that time.

Sincerely yours,
Francis Thorne.

Reply of Lady to Invitation.

"The Cedars."

Dear Mr. Thorne:

It is, indeed, very kind of you to think of my pleasure. The prospect of a ride for Saturday afternoon is very attractive.

I shall be pleased to go with you, and shall await you at three o'clock Saturday.

Sincerely,
Bertha Barry.

October fourth, 1901.

XII. ART OF LETTER-WRITING

A correspondence between two persons is simply a conversation reduced to writing. We should write to an absent person as we would speak to the same party if present. To a superior, we ought to be respectful; to a parent, dutiful and affectionate; to a friend, frank and easy; and clear and definite in our expressions to all.

Conciseness is one of the charms of letter-writing. A letter should contain the desired facts, ideas, and feelings; but they ought to be expressed as briefly as perspicuity and elegance will permit.

Lengthened periods are as much out of place in a letter as they would be in conversation, for they tire the reader even more than they would the hearer. When written, their faults are also perceived with much less difficulty than when spoken.

When the party to whom a letter is addressed is uninterested in the subject on which it is written, the writer of it should display a brevity which will attract attention and insure a perusal. No unnecessary ornament should be used, nor, in fact, anything introduced but what is important and bears strongly on the case stated, or the inquiry made.

To an absent friend, on the contrary, a lengthy epistle, well filled with details of passing incidents, is likely to prove welcome and interesting, and one may venture even upon prolixity if sure that his correspondent has a strong interest in the subject, and is likely to desire minute details concerning it

Style in Correspondence.

The style of the letter may rise with the subject, and with the character of the person written to. In a familiar epistle an effort at dignity of style is misplaced, but such is not the case where the person addressed is superior in position or character, or where the subject is one demanding seriousness and dignity. For instance, the death of a friend or relation, a calamity, or any circumstance of grave importance, should not be communicated in the same manner as a trifling occurrence, or even a happy event:

brevity, in the latter case, is beauty; in the former, it would be deemed unfeeling and abrupt.

Express your thoughts in simple English and in legible writing. The latter should be clear and bold. Never write carelessly or hurriedly; read the letter over before sending; and, if writing more than one letter at a time, be cautious that such are not put in the wrong envelopes. Great attention should be paid to correct punctuation.

As to writing material, the shape and size of paper and envelopes are not so important as the quality. They should be plain white, with no colored border (except the black border when in mourning), and of substantial texture. The address of the writer, printed neatly at the head of the sheet, should take the place of any attempt at ornament.

Fold all letters evenly, and put the stamp in the upper right-hand corner. Remember to enclose a stamp when writing to a stranger concerning your own affairs. Use postal cards only for ordinary business communications; never for friendly correspondence or in writing to any one who might be annoyed by having his or her occupation made public.

Take the trouble to spell correctly. Be careful to write dates, numbers and proper names plainly. Date a note, at the conclusion, on the left-hand side of the page; a letter at the beginning, on the right hand. Sign a letter with a full name, or with the last name and initials. In business correspondence sign "yours respectfully," "your obedient servant," "yours truly," or "yours sincerely." Place the name and address of your correspondent at the upper left-hand corner of the page.

Let your signature suit the style of the letter—a business communication should bear a formal, a friendly note, a cordial conclusion. Between intimate friends and relatives no formal rule is laid down for the beginning and ending of letters. The etiquette of letter-writing should only be considered between strangers or slight acquaintances. In these cases it is well to preserve a mean between cold formality and familiarity.

Forms of Address.

The conventional forms are "Sir," "Dear Sir," "My Dear Sir," or "Madam," "Dear Madam," or "My Dear Madam." Either of these can be used, but to a total stranger "My Dear Sir" is rather too cordial, and to an acquaintance "Sir" is too formal, unless there is a purpose to convey coldness of feeling. When writing to persons of your own social class, though strangers, "Dear Sir" or "Dear Madam" are used in preference to "Sir" or "Madam."

A married lady should not sign herself "Mrs.", nor an unmarried one "Miss," except in writing to a stranger who will need to reply. In this case the full name should be signed, as "Miss Susan Blake," or "Mrs. Mary Brown." Mrs. and Miss may be enclosed in parenthesis. Letters to married ladies are usually addressed with the initials or names of the husband, "Mrs. John P. Smith," etc. Widows and unmarried ladies should only be addressed with their christian names, "Mrs. Mary Smith" or "Miss Fanny Jones." The eldest daughter or unmarried lady of the family should be addressed "Miss" simply, the christian name being omitted. "Mr." and "Esq." cannot be used simultaneously. A letter must be addressed either like the following examples, to "Mr. R. H. Smith" or to "R. H. Smith, Esq." When a letter is addressed to the Hon. James Blank, the "Esq." must not follow.

Never use the husband's title in directing a letter to the wife, as "Mrs. Gen. James Bancroft," or "Mrs. Rev. John Pearl."

Do not cross a letter, put the most important part of it in a postscript, or sign it in the first person, if it has been written in the third. Never fail to answer promptly, in case the communication requires an answer.

When a note is commenced "Sir" or "Dear Sir," it is usual to write the name of the person addressed at the end of the letter or note in the left-hand corner, or it may be put before the commencement; for instance, "To R. H. Smith, Esq.," but in this case it must not be repeated at the bottom.

A son of the same name as his father is addressed in this way: "R. H. Smith, Jr., Esq."

Letters or notes to servants usually begin with the servant's name, and then the directions follow in the third person; example: "To Mary Smith: Mrs. Brown will return home on Saturday next, etc."

Address a clergyman "Reverend Sir" or "Dear Sir," and direct the envelope to "Rev. John Blank;" or if the initial is not known, to "Rev. —— Blank."

Address a doctor of divinity "To the Rev. John Hall, D.D.," or the "Rev. Dr. Hall."

Address a doctor of medicine "J. B. Blank, M.D.," or "Dr. J. B. Blank," or "Dr. Blank."

Address a bishop "To the Right Rev. the Bishop of ——," or "To the Right Rev. H. C. Potter, D.D., Bishop of ——," and begin the letter "Right Rev. Sir," or "Right Rev. and Dear Sir."

Address foreign ministers as "His Excellency and Honorable."

Letters to the President should be addressed "To His Excellency, the President of the United States," or "President of the United States."

Cabinet officers should be addressed "To the Honorable J. C. Blank, Secretary of State," "To the Hon. ——, the Postmaster-General," etc.

In writing to Senators or members of the House, address "To the Hon. ———."

Officers of the army or navy are addressed by their titles, as "General Wilson Earle," "Captain Paul Jones," Admiral William Harvey," etc. The members of a college faculty are addressed as "Professor," and their particular title may be added after the name, as "D.D.", "LL.D," etc. This addition of titular abbreviations applies as well to scientists, physicians, and all others whose special college title may be known to the writer.

Letters of Recommendation.

A letter of recommendation should be composed with careful attention to its statements. It is a guarantee for the party recommended, and truth should never be sacrificed to condescension, false kindness or politeness. To write a letter of recommendation contrary to one's own opinion and knowledge of the person recommended, is to be guilty of a great imprudence.

To say all that is necessary, in a clear and distinct manner, and nothing more, is the grand merit of a letter on business of any kind. Pleasantry and pathos would be greatly misplaced in it, unless it embraced some other subject than the business one. Brilliant diction is a dress in which directions on business should never be clothed. The style ought to be precise, sufficiently copious to leave no uncertainty, but not redundant. Every thing necessary should be stated, plainly and unequivocally; so that the party addressed may be in full possession of our desires and opinions on the subject involved. Ambiguity is nowhere so unpardonable as in a letter on business.

Letters of Introduction.

Letters of introduction are one of the common methods of establishing social relations. The person who is not known to your friend can become known through your kind offices. In this way, very often, important services can be rendered.

Never give a letter of introduction unless you thoroughly understand the character and manners of the person to whom you write the letter and also of the person whom the letter introduces.

You have no right, to avoid giving offence, or through sheer inability to say no to a request, to foist upon your distant friend some one for whose acquaintance he will not thank you and who may prove a very undesirable visitor. If one or the other of the two parties concerned must be offended, let it be the applicant. You can usually give some sufficient reason for declining—but decline in any event, if the person is likely to prove objectionable.

As such a letter cannot well enter into particulars, it is customary and desirable to notify your friend by mail of the fact that you have given a letter of introduction to such a person, and tell him what further it is well for him to know concerning the character and purpose of his probable visitor. If you have given such a letter to a party of whom you do not approve, all that remains is to warn your friend privately, placing him on his guard against a possibly objectionable person.

A letter of introduction (unless sent by mail) should be delivered, unsealed, by the writer of the letter to the bearer of the introduction, and should be closed by the latter before delivery to the party to whom it is addressed. If purely a business introduction and one which can be delivered personally, it may remain unsealed.

The bearer of a letter of introduction should send it to the house of the person to whom it is addressed, together with a card on which should be written his address. It is not in order to deliver it in person, since this may force the party addressed into a position which he may prefer to decline. It does not follow, because a friend has chosen to introduce you to another, that this other may not have private reasons for declining your acquaintance, or may be prevented from seeing and entertaining you by stress of other engagements. If he lives in a large city, the letter may make him feel obliged to escort you to the various places of interest, or in any case to invite you to meals or other entertainments. We should not tax the time or the purse of a friend, except for a satisfactory reason.

The letter delivered, there is nothing more to be done until the party receiving it calls upon you or sends you some card or note of invitation. Those who receive such letters should, within twenty-four hours, if possible, take some kindly notice of them by a call or an invitation.

A letter of introduction must be carefully worded, stating clearly the name of the person introduced, but with as few personal remarks as possible. It suffices in most cases to say that the bearer is a friend of yours, whom you trust your other friend will receive with attention, or you may state his profession, object in traveling, etc. In traveling, one cannot have too many letters of introduction. It is the custom in foreign towns for the newcomer to call on the residents first, a hint that may prove acceptable to persons contemplating a long or short residence abroad.

A letter of introduction of a business nature may be delivered by the bearer in person, since it requires no social obligations. In style it should resemble other business letters; that is, it should be brief and to the point.

If a stranger sends you a letter of introduction, and his or her card (for the law of etiquette here holds good for both sexes), good form requires that you should not only call next day, but follow up that attention by others. If you are in a position to do so, the next correct proceeding is to send an invitation to dinner. Should circumstances not render this available, you can probably escort the stranger to some exhibition, concert, public building, museum, or other place likely to prove interesting to a foreigner or provincial visitor. In short, etiquette demands that you shall exert yourself to show kindness in some desirable way to the stranger, out of compliment to the friend who introduced him to you.

If you invite strangers to dinner or tea, it is a higher compliment to ask others to meet them than to dine with them alone. You thereby afford them an opportunity of making other acquaintances, and are assisting your friend in still further promoting the purpose for which he gave the introduction to yourself. Be careful at the same time only to ask such persons as you are quite sure are the stranger's own social equals.

Letters of Congratulation or Condolence.

Epistles of this kind need to be very carefully written. Unless there is some actual sympathy in the mind of the writer, they had better, in many cases, be left unwritten, since they may serve the opposite purpose to that designed. A verbal expression of feeling, where there is no feeling, is apt to fail of its intention. If such a letter prove difficult to compose, it is likely to seem studied, cold, and formal. Simplicity and ease of expression are necessary elements in a note of condolence or compliment.

A letter of congratulation should avoid any indication of other than unselfish good feeling in the writer. The slightest show of envy or jealousy at the good fortune of those whom we felicitate is unpardonable. It should on no account contain a hint of any hope that the advancement, or change of situation, upon which the compliment is made, may afford the person addressed the means of conferring a benefit on the party writing.

Such a letter should, in fact, be an unmixed expression of pleasure and congratulation on the event that calls for its production. But care must be taken to keep within due bounds; to exaggerate in our congratulations may be to seem satirical.

In a letter of congratulation we should be cheerful; from an epistle of condolence all pleasantry should be banished. When addressing a person who is laboring under any grievous calamity, it is bad taste to make light of it; to treat that loss as a matter which might be endured calmly, by a little firmness on the part of the party who has suffered it, has the effect to irritate rather than soothe. One should seek to enter into the feelings of the mourner, to eulogize the departed relation, to rebuke the ingratitude of the false friend, to confess, the inconstancy of fortune, or otherwise, according to the circumstances; and, without magnifying, to lament the affliction.

Language like this is balm to the wounded mind, which rejects consolation from those who do not seem sensible of the extent of the sorrow under which it labors. But such a subject must be treated with a delicate hand, for an exaggerated expression of sympathy may give the appearance of insincerity, and of a strained endeavor to condole. In such a case it may aggravate the depression which it seeks to remove.

Replying to Letters.

Every letter, that is not insulting, merits a reply, if it be required or necessary. If the letter contains a request, it should either be acceded to gracefully and without ostentation, or refused without harshness. An answer to a letter of condolence or of congratulation should be grateful. The subjects should succeed each other in proper order, and the questions put be consecutively answered. In familiar correspondence a greater latitude of arrangement is allowed; but even in this no question should be left unanswered. In all replies it is usual to acknowledge the receipt, and to mention the date, of the last letter received: if this be neglected, your correspondent may be left in doubt, and may, through misunderstanding, hold you guilty of some offense.

Punctuation.

Punctuation is a matter of the utmost importance in every species of literary composition; without it there can be no clearness, strength, or accuracy. Its utility consists in separating the different portions of what is written in such a manner that the subjects may be properly classed and subdivided, so as to convey the precise meaning of the writer to the reader. It shows the relation which the various parts bear to each other, unites such as ought to be connected, and keeps apart such as have no mutual dependence.

It is much to be lamented that so little attention is paid to this important subject. As there is no positive system of punctuation to direct the writer, the modern editions of good authors should be carefully studied, in order to acquire the leading principles of the art. The construction of sentences may be examined, and the mode adopted of dividing them attended to with considerable advantage.

One cannot expect, perhaps, in this manner to become an expert in punctuation, but may grow sufficiently familiar with its essential elements to make no serious errors. The mode of placing punctuation marks permits of considerable latitude, and it is advisable not to be too profuse in their employment. The use of the comma is frequently very faulty through carelessness in this particular, dividing parts of sentences which naturally cohere, and being dropped in the centre of a phrase in which it is absurdly out of place. The natural halting points for the reader, or slight breaks in the sense, should be duly considered, and a mark placed in consonance with the degree of this break. The comma and the dash do duty with many as the only elements of punctuation, the latter being much over used, through a desire to escape the necessity of considering the proper mark required.

Postscripts.

Lady writers have been accused, and perhaps with some reason, of often reserving the most important part of a letter for the postscript. It is an accusation which they should avoid giving cause for. Postscripts are, for the most part, needless, and in bad taste. It is best to pause a few moments before concluding a letter, and reflect whether we have anything more to say. Above all things, none should defer civilities or kind inquiries to this justly-despised part of a letter. To do so is a proof of thoughtlessness or disrespect. "My kindest regards to my cousin Lucy," added as a postscript, looks like what it really is—an after-thought; and is, therefore, not only without value, but, to persons of fine feelings, offensive.

To all writers something will occasionally occur, after finishing the letter, which it is important to state. If to have forgotten it implies no disrespect it may properly be added as a postscript. But if it should indicate a forgetfulness which may possibly offend the recipient, the whole letter had better be rewritten, and the after-thought put in its proper place.

XIII. FORMS OF CORRESPONDENCE.

Having given in the preceding sections some hints as to letter-writing and examples of notes of invitation, acceptance, and declination, it seems important to append some more diversified examples of letter-writing and correspondence, as brief guides to a broad domain of social duty and obligation. Letters of this kind are endlessly diversified in form and purpose, and a few examples, chosen largely at random, must suffice.

Ordering Goods.

In ordering goods be careful to state exactly what you want, and whether you wish goods delivered by freight or express.

It is customary in writing orders to use abbreviations for mercantile terms which are known among business men.

Should you wish to ask any questions or to make suggestions, write these upon a separate sheet from the order itself.

Send your order some time before you need the goods, so that you may not suffer on account of any slight delay upon the sender's part.

Danville, Va., Dec. 20, 1903.

Strawbridge & Clothier,
Philadelphia, Pa.

Dear Sirs:

Enclosed find draft for $75 on First National Bank of Danville, for which please forward by U. S. Express:

6 pairs White Kid Gloves, No. 6.
3 pairs Brown Kid Gloves, No. 6.
1 dozen Linen Handkerchiefs lady's size.
15 yards of Silk like sample enclosed.

The amount overpaid in my remittance you may place to my credit subject to future orders.

Respectfully,
(Mrs.) Julia D. Brown.

Application for a Situation as Teacher.

Salina, Kansas, July 5, 1902.

Gentlemen:

Understanding that a vacancy for the situation of teacher in your school has occurred, I beg to offer myself as a candidate, and to inclose my certificate and letters of recommendation from persons you no doubt know. While I feel that these can better speak for me than I can for myself, I venture to assure you that, should you appoint me to the position, I shall strive to discharge my duties earnestly and steadily, and shall ever remain,

Your grateful and obedient servant,
Jeanette Wilson.

To the Trustees or Principal of School.

Introducing a Young Lady Seeking Employment.

Brooklyn, May 2, 1903.

Dear Mr. Martin:

This will introduce to you my friend Miss Mabel Beechem, who is desirous of obtaining employment in your city. I use our old acquaintanceship to interest you in her behalf. She has received a very liberal education, and would prove of great value to a family whose *young children need careful and judicious teaching. She is gentle, amiable, and willing. I trust you will be able to serve her, and I shall greatly appreciate the attention you may give her.*

Very truly,
Barclay Jones.

To Mr. Joseph Martin,
2175 Pine Street Philadelphia, Pa.

Introducing a Friend.

St. Louis, Mo., Jan. 3, 1901.

Dear James B.:

This letter will introduce to you my dear friend William White, who is to be in your city for a few days on business and pleasure. I desire him to meet you and trust it will be convenient for you to give him a few moments of your time.

Any attention you give him during his stay in Chicago will be greatly appreciated by

Your friend,
Charles F. Jenkins.

Mr. James B. Smith,
141 Wabash Avenue, Chicago.

Short Form of Introduction.

Chicago, Ill., June 11, 1900.

My Dear Sir:

I have the honor of introducing to your acquaintance Mr. Frank Ward, whom I commend to your kind attention.

Very truly yours,
William S. French.

Mr. Benj. F. Strong,
Detroit, Mich.

Congratulating a Gentleman Upon His Marriage.

Wilmington, Ohio, Sept. 12, 1900.

Dear Frank:

I have just received the welcome message informing me of your new happiness. I hasten to offer you my most sincere congratulations and hearty good wishes. May every year of your married life find you happier than the last, and may Mrs. Cranston find you as loyal a husband as you have been a friend.

From my inmost heart, dear Frank, I say, God bless you and your bride with His choicest blessings.

Ever your friend,
George Maris.

Mr. Frank Cranston,
Newport, Del.

Congratulating a Lady Upon Her Marriage.

179 D St., N. W.
Washington, D. C., Nov. 4, 1903

Dear Emma:

Your cards have just reached me, and I write at once to try to express my heartfelt pleasure at your happy prospects. It is a great pleasure to your loving friends to be able to feel so much esteem and affection for the gentleman to whom you have confided your life's happiness, and to hope, as I do, that every year will unite your hearts more closely.

That Heaven may bless you both, dear Emma, is the earnest prayer of

Your loving
Laura Shipley.

Mrs. J. Barrie Brown.

A Letter Sent with a Gift (a Book).

977 President St.,
Brooklyn N, Y., Dec. 20, 190–.

My Dear Friend:—I hope the accompanying volume, of which I ask your acceptance as a slight token of my regard, will suit your taste. Books are in themselves friends, and are therefore, I think, the most appropriate souvenirs of friendship. In fact the current phrase, "I know you like a book," although a vulgarism, seems to imply the same intimate relation between reader and author that should exist between friend and friend. Please apprise me of the receipt of the package, and believe me,

Ever yours sincerely
John Clark.

To Miss Julia Thomas, Brandywine, Del.

The Reply.

Brandywine, Del., Dec. 23, 190–.

My Dear Mr. Clark:—Accept my thanks for your handsome present. You could not *have selected a book that would have pleased me better. I think with you that books (of the right kind) should be looked upon as agreeable and useful friends; but nevertheless the friend whom neither time nor distance can estrange, is a treasure of more value than all the volumes that ever were printed. Permit me to regard you in that light, and again thanking you for your present, to remain,*

Sincerely yours,
Julia Thomas.

To Mr. John Clark, Brooklyn, N. Y.

Soliciting a Loan from a Friend.

2790 N. Broad St.,
Philadelphia, Sept. 9, 1903.

My Dear Sir:—A disappointment in the receipt of some money due has exposed me to a temporary embarrassment. The sum which would extricate me from this painful difficulty is not large, as $400 would be amply sufficient to release me from my present pressure. I have so great an aversion to borrowing money from professional lenders, that I prefer the course of soliciting the aid of some well-known friend. I have thought of several, but of none with a greater degree of confidence than yourself. Can you grant me, then, the accommodation of the above sum, without in any way intrenching on your own convenience? If you can, I believe I may rely on your readiness to do so; and you may in turn depend being reimbursed with the strictest punctuality by the 5th of April. A speedy reply to this request will extremely oblige,

My dear sir,
Yours most sincerely,
Joseph Howard.

To Mr. Frank Thomson.

In Answer Declining, on Account of Incapability.

1785 Mulberry Street,
Philadelphia, Sept. 10, 1903.

My Dear Sir:—I truly regret that my circumstances will not permit me to oblige a friend so dear to me as yourself; but at present I am in great need of money, and last Friday I was compelled to borrow, to meet a pressing obligation; I therefore do not have it within my power to comply with your request.

Trusting that you may be more successful in some other quarter, and with feelings of regret at my own inability to render you a service which you might otherwise readily command,

Believe me to remain,
Ever your sincere friend,
Charles Hall.

To Mr. Joseph Howard,
No. — Lexington Ave., N. Y.

A Letter to a Friend (on the Anniversary of his Birthday.

1917 Green Street,
Philadelphia, July 3, 190–.

My Dear Walter:—Birthdays may be called the milestones in life's journey, and as you reach another of these anniversary land-marks to-day, permit me to congratulate you on having traveled them thus far in safety, and to wish you, with all my heart, many similar opportunities of receiving the good wishes of your friends. That your future years may glide happily away, without care or sorrow, is the sincere prayer of,

Yours most sincerely,
Thomas Meek.

To Mr. Walter Dewey,
Crestline, Ohio.

Reply to the Above.

Crestline, Ohio, July 10, 190–.

Dear Tom:—Congratulations that come from the heart, as I am sure yours do, are always welcome. I scarcely know, however, whether we ought to be complimented on growing older, unless we grow wiser and better as well. Nevertheless, the custom of receiving the felicitations of one's friends and acquaintances, on having made another step toward the goal, is decidedly an agreeable one, and I thank you most cordially for your kind note.

Your obliged friend,
Walter Dewey.

To Mr. Thomas Meek,
Philadelphia, Pa.

Requesting a Friend to execute a Commission.

Santiago, Cuba,
April 15, 1902.

My Dear Emma:—Will you kindly execute the following little commissions for me, as *soon as you can make it convenient? Purchase for me at Macy's the following articles;—(here state ribbons, muslins, &c., as wanted.) Will you also call at Doubleday's and inquire when Bacheller's new novel will be out, as I am all anxiety to know.*

Please give them my address at Macy's, and tell them to pack the parcel carefully and send it by express.

The weather down here is delightful; but I wish I had the pleasure of your company to render it more so. Pray write a line and let me know how soon you can make me a visit, and thus afford me an opportunity to thank you personally for your kindness.

Lois C. Pharnum.

To Miss Mary White,
No. — Washington Square, New York.

Application for Subscription to a Charity.

Duane Street,
Louisville, Ky.,
January 17, 190–.

Sir.—I take the liberty of inclosing a prospectus of an institution which is likely to have a most beneficial effect upon the condition of the poor in our neighborhood. (Here state particulars.) On account of your well-known liberality, I trust you will excuse this appeal in furtherance of an act of benevolence, and remain,

Sir, your most obedient servant,
Harry R. Jones.

To Pliney Earle, Esq.,
No. — West 18th Street, City.

Letters of Application.

BOY WANTED for Transportation Office; must be good penman; $15 per month. Address, in own handwriting, H, 236 Ledger Office.

Philadelphia, Pa., Jan. 3, 1901.
H, 236 Ledger Office.

Sir:—I would respectfully apply for the position advertised in to-day's Ledger. I am fifteen years old, reside with my parents at 79 Jayne Street, Camden, and refer you to Mr. S. L. Thomas, 814 Market Street, this city, from whom I received the enclosed testimonial.

Very truly,
Albert Jenkins.

Application for Position of Salesman and Collector.

100 D St. N. W.
Washington, D. C.,
March 21, 1901.
Messrs. S. H. Smith & Co.,
Wheeling, W. Va.
Gentlemen:

I am recommended by Mr. Frank Stuart to apply to you for the position of salesman and collector, recently occupied by him in your warehouse.

I am twenty-eight years of age, and reside with my father in this city, who will give bonds for me if required. I have had some experience in your line of business, and should be pleased to have a trial with you, if preferable, previous to a permanent engagement. I am at liberty to refer to Messrs. W. H. Fletcher & Co., Lace Curtains, 198 Broadway, New York, also to Messrs. Simpson & Jones, Upholstery Goods, 166 Arch Street, Philadelphia, Pa.

Very respectfully,
Edward Murphy.

Requesting the Settlement of an Account.

Newark, N. J., Dec. 25, 1900.
Mr. James Jones,
Burlington, N. J.
Dear Sir:

I call your attention to the fact that your account, which I enclose, has not been settled. I am reluctant to press you, but as I have some heavy payments to make in the early part of next month, I must request that you pay the amount before the close of the present month.

Respectfully yours,
John Adams.

A Demand for Payment of Rent.

1409 North Ninth St.,
Philadelphia, Pa.
June 5, 1904.
Mr. Thomas F. Smith.
Dear Sir:

I feel obliged to remind you of the fact that you owe me $120 for three months' rent. You will remember that, according to the agreement, you were to make monthly *payments; therefore, if the account is not settled within a week, I shall be obliged to place the matter in the hands of my lawyer for collection, as I cannot allow it to run any longer.*

Truly yours,
Henry S. Holmes.

Introducing a Young Man Seeking a Position.

Akron, Ohio, June 1, 1900.

My Dear Sir:

Recognizing your well-merited and extensive influence in the commercial circles in your city, I beg to introduce to you Charles F. Pogle, who is desirous of obtaining a position with a mercantile house. He is a gentleman of capacity and ability. His character stands A 1, and he is as industrious as he is energetic. He considers New York a better field than this place, and prefers to try his chances there to remaining here. He can refer to me. Trusting that you will lend him a helping hand, I am, *Yours, very truly,*
James B. Marvel.

Mr. Edward Fetter,
19 Park Row, New York

Social Letters.

Let these be original and not be like the epistles of some one else; write as you would talk, but always exercise care in the use of pure, simple language and avoid a stilted or artificial style. Especially in the long letters of friendship and love—those missives that reveal the heart—the language should show that the heart is pure. Let your letter be the record of the fancies and mood of the hour; the reflex of your aspirations, your joys, your disappointments.

Write cheerfully. It is unkind to your friend to fill your letter with complainings and accounts of your troubles, though there are occasions when one may confide all his sorrows to the near friend, and receive in return a letter of sympathy, containing all the comfort it is possible for a letter to convey.

The length of social letters must depend upon circumstances and degree of intimacy. To members of your family real chatty letters telling of all the little incidents of your life, its pleasures and adventures are always proper. In fact, these need be limited only by your time and paper. To others you must not write such long letters.

The following is a feeling letter of condolence, written by Frances Ridley Havergal to a lady friend:

Leamington, Dec. 10, 1870.

Dear, Dear Mrs. Smith:

What can I do but just weep with you! I can only guess what this sorrow is. Only I know it must be the greatest, except one, which could come to you. That dear little, beautiful thing! He looked so sweet and happy when I saw him; no baby face ever haunted me as, somehow, his did. If you could only see him now, how beautiful he must be now that he has seen Jesus, and shines in the light of God. It is even more wonderful to think of that great transition for a baby than for a grown person; one cannot imagine the sudden expansion into such knowledge and conscious joy.

I was looking back this morning upon long memories of soul-trials, years of groping and stumbling and longing, sinning and sorrowing, of heart weariness and faintness, temptation and failure; all these things which I suppose every Christian must pass through, more or less, at some stage or other on the way home; and the first distinct thought which came through the surprise and sorrow at the sad news was, "That dear little redeemed one is spared all this, taken home without any of these roughest roughnesses of the way; he will never fear doubt or sin, never grieve his Saviour." Is it not the very best and kindest thing that tender Saviour could do for him? Only it is not what you meant when you prayed that he might be his own.

But better he is with him at once and forever, and waiting for you to come home. I am only writing all this because my heart is full, and must pour out a little. I know we cannot comfort,—only Jesus can; and I shall go and plead long and intensely for this as soon as I have closed my letter. He must be specially "touched" in such a sorrow, for he knows by actual experience what human love is. Three such great sorrows in one year! How specially he must be watching you in this furnace!

Yours with deepest sympathy,
Frances R. Havergal.

This may fitly be followed by a letter of congratulation, of which we give a manufactured example. Too often it is the case that friends forget to congratulate those they are interested in when good fortune of any kind comes upon them, or to commiserate with them in cases of disaster or misfortune. These letters not only are proper but very acceptable. The one receiving such letters should not fail to acknowledge them. They properly should not be very long or very effusive.

New York, May 8, 1903.

My Dear Mr. Williams:

It is with deep satisfaction that I learn of your good fortune. I have long hoped that the clouds which lowered over you would be lifted, and sincerely hope that you have fairly entered upon a tide of prosperity. In one who, like you, have been true and honorable in all your actions, and have suffered in means through honesty in dealing, the coming of a measure of success like this should be especially gratifying.

May you continue to prosper, and if in any way I can advance your interests in this quarter do not fail to make use of me. Present my best wishes to Mrs. Williams, and believe me

Sincerely yours,

James Dobson.

From Charles Dickens to James T. Fields.

As an excellent example of a reply to a letter conveying pleasant wishes, we present the following from Dickens:

Gad's Hill, June 10, 1867.

My Dear Fields:

Your letter of May 27th comes to me like a breath from your own world beyond the sea. Believe me, I reciprocate all your good wishes, and take this occasion to renew those sentiments of respect and affection for yourself which it has been my privilege to entertain for so long a time. In the busy hours of exacting labors, I recall with pleasure the choice friends whom it has been my happy lot to meet. Time does not rust, but brightens, the links of the golden chain. With every good wish for your personal health and enjoyment, I am, as ever,

Yours most sincerely,

Charles Dickens.

Mr. James T. Fields,
Boston, Mass.

From Charles Sumner on Leaving for Europe to his Ten-year Old Sister.

Astor House,
New York, Dec. 7, 1837

My Dear Julia:

I don't remember that I ever wrote you a letter. I feel confident, however, that your correspondence is not very extensive; and therefore I flatter myself that what I write you will be read with attention, and I trust, also, deposited in your heart. Before trusting myself to the sea, let me say a few words to you which shall be my good-by. I have often spoken to you of certain habits of personal care, which I will not here more particularly refer to than by asking you to remember all I have told you.

I am very glad, my dear, to remember your cheerful countenance. I shall keep it in my mind as I travel over sea and land, and hope that when I return I may still find its pleasant smile ready to greet me. Try never to cry. But above all things never be obstinate or passionate. If you find your temper mastering you, always stop till you count sixty before you say or do anything. Let it be said of you that you are always amiable. Love your father and mother and brothers and sisters, and all your friends; cultivate an affectionate disposition.

If you find that you can do anything which will add to the pleasure of your parents, or anybody else, be sure to do it. Consider every opportunity of adding to the pleasure of others as of the highest importance, and do not be unwilling to sacrifice some enjoyment of your own, even some dear plaything, if by doing so you can promote the happiness of others. If you follow this advice you will never be selfish or ungenerous, and everybody will love you.

Study all the lessons you have at school, and when at home, in the time when you are tired of play, read some good books which will help to improve your mind. . . . If you will let Horace read this letter it will do the same, perhaps, as one addressed to him. Give my love to mother, and Mary, and the rest.

Your affectionate brother,

Charles.

ETIQUETTE OF BEAUTY

During all civilized ages the art of beauty has been sedulously studied and practiced by the fair sex, women in all periods since the days of barbarism having sought to preserve and increase the charms bestowed by nature and carry the freshness of youth as far forward as possible into the domain of middle life and even of old age. Experience extended through many centuries has yielded numerous "rules of conduct" in relation to physical hygiene and the care of the body, while physicians have learned much in respect to the preservation of health and beauty. How to keep a clean soul in a clean body is the first law of health. In the study of the fine arts there is nothing of more importance than the art of making a beautiful woman. It is this art with which we are at present concerned. Though no one can be taught how to convert ugliness into beauty, or to stay the footsteps of age, yet what share of attractiveness nature has given can in great measure be retained and enhanced, while, if the advance of age cannot be checked, its ravages may be alleviated and its harshness softened by the employment of physical hygiene and refined care of the body which God has given us.

How to Grow Old Gracefully.

A charming old lady revealed the secret of her fair and rosy complexion to a group of young women as follows: "Late hours," said she, "and oversleeping ruin the complexion. Go to bed early, arise early, and you will grow old slowly, and retain your good looks to an advanced age. If, however, your position forces you into society and you are obliged to be up late at night, sleep an hour every afternoon. Before going to bed take a hot bath and remain in the water only a few moments. Then drink a cup of bouillon, and a small glass of Malaga wine. Sleep will soon follow, and last until the natural time of awakening, which is about ten o'clock in the morning under these circumstances. Take a cold plunge or sponge bath, a light breakfast of *café au lait*, and bread without any butter."

She continued: "Out-of-door exercise is an absolute necessity, but must not be carried to excess. A daily walk is excellent, and it is scarcely necessary to say that whole days of lawn tennis, croquet, etc., are not favorable to the complexion."

Care of the Body.

Wear warm, light garments, to secure an even temperature. In winter it is even more important to protect the spine than the chest. Wear a silk sleeveless jacket next the skin, if you do not wish to wear a flannel one. At any rate, if you are delicate, young or old, cover the spine with a strip of flannel tied by a ribbon, and extending to the hips. There will be no need to fear colds, bronchitis, or phthisis, if this precaution is taken, and it does not prevent wearing a *decollette* gown.

Never wear tight clothing. It is injurious to health and beauty. The face becomes congested when the organs are compressed, the hands swell, and get red, and the carriage awkward. Wear easy corsets, gloves, and shoes.

To keep the pores of the skin open, one should bathe daily in cold or warm water; ill health and age are thus retarded. The result of uncleanliness is a flabby and unwholesome condition. The well cleansed skin is soft, smooth, fresh; a skin on which perspiration and dust have accumulated in layers becomes dry and feverish. But it may be said that it is not possible for the greater number of people to take a daily bath, as they lack the facilities and the time. The sponge bath—which is all sufficient for the purposes of cleanliness—requires only a few minutes each day. Once or twice a week at least, one should take the time necessary for a full bath. This is the very least attention our bodies require.

Immersions and baths, with the aid of soap, lotions, etc., will render the body strong and flexible, and give it a power of resistance. Water has the virtue of dispelling fatigue and destroying the germs of disease. While cleansing the body it purifies our souls and gives us "a sound mind in a sound body."

The Bath-Room.

The furnishing of the bath-room depends largely upon the means and taste of its owner. It is no difficult matter to furnish a simple bath-room, in which comfort may be preserved while the unattainable elegancies of the rich are banished. The walls of this room may be painted in oils—in imitation of marble, if desired. Over the floor of wood or tiles a carpet of linoleum should be spread. In front of the bath-tub should be laid an India-rubber mat, on which to step on leaving the bath. On the walls may be placed shelves for soap, sponges, etc., within easy reach of the hand while in the water. On racks or in a wardrobe should be hung the bathing linen, towels, dressing sacks, and other necessaries of the bath.

The human skin is a complicated net, whose meshes must be kept open and unclogged, in order that through them the body may throw off its impure secretions. The healthy action of the skin is stimulated by the opening of the pores in the bath, especially if it is followed by friction with a brush or rough towel.

Instead of the bath-tub and its accessories, the needs of cleanliness may be met with a large zinc tub, a pail, and a small basin of water, with a suitable sponge. In this method of bathing first use warm water; then, if in good health, lower the temperature of the water until, finally, the bath can be taken cold. In all cases the temperature of the room must be moderately warm. People whose lungs are weak should always bathe in warm water.

Partial baths, of any kind, are almost always taken warm. It is unwise to bathe immediately after eating, as it seriously interferes with digestion. There should be at least three or four hours between a full repast and a bath.

In the springtime, when one is more susceptible to cold than at any other season of the year, it is best to bathe at night, just before going to bed, in order that the skin may profit by the warm moisture which it retains for several hours after leaving the bath.

The practice of massage, by the hands of an experienced operator, is of great value in certain states of the health. But, fortunately, ordinary friction can replace this practice without assistance, thanks to the various appliances for the purpose of rubbing one's self over the shoulders and back, which the hands cannot reach easily. The friction is produced either with the bare hand, or by means of gloves or bands of horse-hair, or of rough woolen or linen cloth. When no liquid is employed, such friction is called dry.

The Dressing-Room.

A woman's dressing-room should be as tasteful and comfortable as her social position and fortune permit: simply comfortable if she cannot afford luxury, but supplied at least with all things necessary and useful to a careful toilet.

Where convenient, two dressing-tables should be provided, facing each other, different in dimensions, but identical in form.

The larger serves for the minor ablutions. It is provided with a water pitcher and bowl of porcelain, crystal, or silver, selected with the taste which distinguishes us in these days. Above it fasten a little shelf on which to place perfumes, smelling salts, dentrifices, elixirs, etc. Beside the bowl place a soap-dish, a box for brushes, etc.

The smaller dressing-table should be surmounted by an adjustable mirror, framed in silk and muslin. The hair is dressed before this table. It must be supplied with all needful accessories—brushes and combs, perfumes, creams and lotions, powder-boxes, powder-puffs, manicure set, etc. Projecting brackets for lights should be on each side of this table.

The dressing-room may be far more simple than here described. If it lack all luxury, a woman of taste may give it an attractive appearance. Select a tasteful wall-paper. Cover the floor with a pretty rug. Tables of pine may be draped with cretonne bordered with a ruffle. Over your dressing-table spread a linen scarf trimmed with inexpensive lace. Above it hang small brackets covered like the table, on which place the boxes, bottles, jewel vases, etc., which may be graceful and elegant despite their small cost. If the mirror is ordinary, conceal the frame by a drapery to correspond with the table. This is easily arranged by means of hidden tacks. Secure a very simple wardrobe, which you can greatly improve by painting and varnishing. Conceal the water jugs and pails under the valance of the table.

Some shelves at the end of the room, with hooks beneath them to hold articles of clothing, the whole concealed behind curtains in harmony with the drapery of the table, will answer the purpose of a wardrobe. The curtain should hang freely from the ceiling, so as not to expose the outlines of the objects behind it. Beneath it the zinc bathing tub may be hidden.

The Complexion.

It is generally thought that the color and texture of the skin may be improved by external means. This is partially the truth, but is largely an error, since the complexion depends to a great degree on the health and temperament. We must look to hygiene rather than to cosmetics to supply the defects of color.

A complexion which is too highly colored, especially if the color is deep and extends over nearly the whole surface, is neither desirable from an æsthetic nor from a hygienic standpoint. It indicates plethora. It will be noticed that those persons who are afflicted with high color, whose eyes even are veined in red, are usually large eaters, lovers of ease, and averse to fatiguing exercises. In order to tone down their color, they should restrain the appetite, select less succulent food, and take less ease. Their health will be improved by the directions here given ; headaches, confusion of thought, dizziness, will disappear ; from violent, the color will become merely brilliant, which is a very different thing, for a bright color is not objectionable if confined to the cheek, as it makes the rest of the face fairer by contrast.

When the complexion is muddy, wan, pasty, too white, greenish, yellow, or purple, it is always a sign of bad health. A muddy skin is sometimes natural, but frequently indicates dyspepsia, feeble circulation, etc.

A pale skin is usually due to a life spent within doors, lack of exercise, the habit of necessity of avoiding sunlight and daylight. A pasty skin is the result of a lymphatic temperament. An olive skin does not always indicate disease ; it may have been inherited from some creole ancestor. A too white skin, without proper admixture of color, shows a person in serious ill health, although sometimes there are no other indications. A purplish complexion may come from some affection of the heart. A yellow skin requires especial attention. It is plain that care and precaution should be taken when the complexion is defective.

Hygiene is in many cases sufficient, and we shall try to trace the prominent outlines of this preventive treatment, at least so far as women are concerned.

Facial Ablutions.

It is well known that the pores of the skin should be kept open in order to perform thoroughly their functions, and that washing is an excellent means to relieve them of the secretions or accumulations which obstruct and close them. There are, however, precautions to be taken when washing the face. If there is any eruption on the face, warm water should be used. By this means the blood is driven away and the congestion relieved.

When the weather is very warm, or when the face is heated, do not wash in cold water. Bathe in warm water with pure soap. Take care to rinse thoroughly, so as to remove every particle of soap. Powder lightly, allowing the powder to dry on the face.

The face should be then carefully wiped on a piece of soft linen. Rough friction, with a coarse towel, has the effect of thickening some skins. It is well to remember that the skin requires the same delicate care that we bestow on fine porcelain or other rare treasures.

It is said that one of our society beauties every night on going to bed saturates a toilet towel in very hot water, wrings it, and applies it to her face, keeping it there for half an hour. This woman has no wrinkles.

A woman, fifty years old, whose skin is as smooth as that of a young girl, has never used anything on her face but hot water, which she believes prevents the skin from becoming flaccid and wrinkled. One of her friends does the same, but immediately after washes her face in cold water, and her sister uses hot water at night and cold in the morning.

All these apparent contradictions depend doubtless on different conditions of the skin. A well-known physician advises washing the face in cold water in the winter, and in warm or hot water in summer, thus establishing harmony with the existing temperature.

Hard water, which does not dissolve the soap, should not be used for washing or bathing. If no other is to be had, the water for face-washing may be softened with a little borax or a few drops of ammonia.

Lemon juice cleanses the skin very well, and sometimes serves the purpose better than soap. Strawberry juice has the same effect, besides being very improving to the skin.

Dr. Kingsford believes that, in many cases, the skin of the face may be kept smooth to an advanced age by the following mechanical process: The fingers being slightly oiled, the skin of the face should be rubbed, gently but firmly, in a direction opposite to that in which wrinkles threaten to form. This should be done at least once daily, and for five minutes at a time. The pressure must be even, firm, and gentle, and the oil on the fingers occasionally renewed. In this process the effect may be much augmented by the use of wool fat, a substance which is extracted from sheep's wool. Its value consists in the fact that it is readily absorbed by the skin, and thus serves to replace the subcutaneous fatty tissue, where deficient, and give a full, smooth, and rounded outline to the skin. Cold-cream prepared from this wool fat and cucumber juice is a very valuable cosmetic, from the readiness of its absorption by the skin, ordinary oils and fats lying on the surface, without absorption, and forming a greasy film.

To Remove Sunburn.

Bathe your face at night with a cold infusion of fresh cucumbers sliced in milk. A decoction of tansy in buttermilk is still more efficacious. Buttermilk alone is excellent.

Another means of overcoming the effects of sea or wind is to wash the face with the juice of green grapes prepared in the following manner: Wet the grapes and powder lightly with alum; wrap in a white paper and cook under hot ashes. When the grapes become tender they are sufficiently cooked. Remove them from their covering and squeeze into a cup. Wash your face in the liquid three times within twenty-four hours. This remedy is said to be infallible.

Another treatment, practiced in Italy, is to bathe the face with the white of an egg, well beaten. Let it dry on the skin, and rinse it off in soft water after fifteen minutes. This treatment is repeated three or four times, always at night, just before retiring.

Lastly, good results may be had from the use of a mixture of equal parts of glycerine and lemon juice. If glycerine does not agree with the skin, use rose-water.

Freckles.

Freckles are the despair of blondes, and even of brunettes with fair skins. Some physicians attribute them to too much iron in the blood, and think that they may arise from the abuse of iron tonics. Others say that they indicate a delicate constitution and feeble circulation.

They may sometimes be prevented by a few very simple precautions. The following mixture has been used with success: One part of tincture of iodine to three parts of glycerine, applied to the freckles before going to bed.

Another remedy is the following: Take one-half pint of oil of turpentine; dissolve in it seven grammes of pulverized camphor; add two grammes of oil of sweet almonds.

The following is another excellent remedy: Twenty-eight grammes of crushed camphor and 112 grammes of pure olive oil. Let the camphor dissolve slowly in the oil.

Applications of buttermilk are also excellent here, as in the case of sunburn.

The following remedies are also recommended: In twenty centigrammes of rose water dissolve sixteen centigrammes of borax:

Fresh beans, boiled in water, crushed and applied as a poultice on the freckles, will produce excellent effects.

Make a mixture of vinegar, lemon-juice, alcohol, oil of lavender, oil of rose, oil of cedar, and distilled water. Apply to the freckles on retiring, and wash the face in soft water next morning.

Two parts of sugar of watercress to one of honey is highly recommended for removing both large and small freckles. Strain through a cloth and apply morning and night.

Depilatories.

The growth of hair which so often appears on the chin at middle age, and the down which imparts a masculine appearance to the rosy lips of some young girls of twenty, form causes of annoyance from which some suffer distress of mind. There are, fortunately, remedies for this affliction.

Removing these hairs with a small tweezer of steel is one of the common methods. But the hair must be carefully pulled and not broken ; it should be removed by a sudden jerk. Recently an operation by electricity, to which the name of electrolysis is given, has been highly recommended. It is, however, often unsuccessful, and always painful.

Make a wash of the leaves and roots of celandine distilled. Make a compress, apply to the hairy spot, allowing it to remain on all night. Continue until the hairs disappear.

Use polypode of oak ; slit and cut into pieces, place in a cucurbite (vessel resembling a gourd used in distillation) and pour over it some white wine, which should cover the polypode a finger's width. Let it stand for twenty-four hours. Then distil in boiling water until no more evaporates. Apply in compresses on the afflicted parts, keeping it on all night. Renew until the desired effect is produced.

Face Washes and Cosmetics.

Never use any kind of paint on the face. All rouges injure the skin. Blanc de perle is dangerous.

Greasy skins are benefited by washing in the juice of fresh cucumbers. Equally good is the water in which spinach flowers have been boiled. The juice of strawberries is still better.

During the sixteenth century the water in which beans had been boiled was in vogue for the complexion. This farinaceous water is entitled to the fame which it possessed. Belladonna (beautiful lady) derives its name from the use which the Italians of the Renaissance made of its juice to improve their complexions.

The following lotion is excellent : A wineglassful of lemon juice, a pint of rain water, five drops of essence of rose, well corked. Wash the face occasionally with this mixture, which often prevents the discoloration of the skin.

Soft and relaxed skins will be improved by the use of the following cosmetic (at intervals of eight days) : One part milk, one part whisky. Moisten a soft towel with the mixture, after having first washed the face. The results do not follow immediately, but within a year the skin will frequently contract, become firm, fine, and soft.

An excellent cleansing wash, used by our grandmothers, and known as "virginal milk," is prepared as follows : Take one quart of rose, orange, or elder-flower water, and add to it, drop by drop, stirring constantly, an ounce of simple tincture of benzoin. (Be careful not to use compound tincture). A few drops of glycerine and twelve or fifteen minims of tincture of myrrh may be added.

For greasiness of the skin the use of stimulating and astringent washes is necessary. The following is an excellent recipe : One ounce of dried rose leaves, one-half pint of white-wine vinegar, one half-pint of rose-water. Pour the vinegar on the rose-leaves and let it stand for a week ; then strain and add the rose-water. Bathe the face morning and evening by wetting the corner of a soft towel with the lotion.

Where the oiliness is considerable, use the following lotion, applying it two or three times a day :

Sulphate of zinc, two grains ; compound tincture of lavender, eight minims ; distilled water, one ounce. Mix thoroughly.

Toilet vinegars are frequently made with diluted acetic acid, into which are infused rose-leaves, lavender, verbena, or some other perfume. All toilet vinegars should be much diluted. The best time to use them is in the morning after bathing, in order to cool the skin, remove any appearance of greasiness, and give tone to the epidermis. But they must on no account be used soon after soap has been applied, because the acid of the vinegar will decompose the soap and seriously injure the skin.

The Use of Rice Powder.

It is sometimes necessary to powder the face, but powder should be applied lightly and artistically in order to impart to the skin the velvety softness of the peach. Powder on the face should be imperceptible, and, if used with discretion, is not to be condemned.

Take up but a small quantity of powder on the puff, and pass lightly over the face. Care should be taken not to powder the eyebrows, and the lips must be carefully wiped to remove any powder which may have fallen, The whole face, except the eyes, the eyebrows, and lips, should receive a touch of powder.

Acne or Blackheads.

Acne is the commonest form of facial eruption, it appearing as small black points on the nose, cheeks, and chin. Each speck marks an obstructed outlet of the sebaceous glands, and if pressure be made on either side, the oily secretion may be pressed out in the form of a small white worm. With care in softening the skin before pressing, blackheads may be removed without leaving a scar, and through proper treatment, their return may be prevented.

For three weeks, or until the skin is thoroughly softened, apply Récamier cream every night before retiring. Let the cream remain on the face during the night. In the morning wash it off with water, as hot as can pleasantly be borne, and a little pure soap. Rinse the face thoroughly with cooler water. At the end of three weeks the blackheads will, in most cases, have been expelled by the treatment. In obstinate cases proceed as follows:

Before attempting the removal of these blemishes, apply a little Récamier cream. Press on either side of the clogged pore until the so-called "worm" is forced out. Be careful not to be rough and injure the skin by sharp finger nails or any steel instrument; if the sebaceous matter will not come out, it is because the skin is not properly softened, and you must patiently continue the first part of the treatment. Operate on the blackheads at night, if possible, before retiring, and do not attempt to get rid of all at one time. After the matter is forced out, bathe the face in warm water, in which put a little pulverized borax, and also use a little pure soap, that the now emptied folicle may be thoroughly cleansed. Continue this treatment until the black heads are all gone.

Do not imagine, however, that these troublesome imperfections will not return if the skin is neglected. Nothing but care and great cleanliness will effectually banish these obnoxious visitors.

Redness of the Nose.

If this affliction is due to the dryness of the nasal passage or the delicacy of the capillary vessels, the inflamed condition may easily be removed. The following wash can be recommended: Powdered borax, ten grammes; one teaspoonful cologne; soft water, 150 grammes. Melt the borax in the water, then add the cologne. It is sufficient to moisten the nose with the wash and let it dry without wiping. When it begins to burn again, the treatment should be renewed.

Here is another and similar wash: Dissolve two grammes of borax in fifteen grammes of rose-water, and as much orange-flower water. Moisten the nose three times each day with this refreshing wash.

Cleansing of the Hair.

The frequent use of a fine comb is fatal to hair, especially when it is falling out. However, it is necessary to cleanse the hair and the downy scalp.

The Chinese, who have abundant, but coarse, hair, use a mixture of honey and flour.

The following is an English recipe: Add a teacupful of salt to a quart of rain-water. After twelve hours this brine is ready for use. To one cupful of the mixture add one cupful of hot rain water. Wash the hair and scalp, rub well, rinse, and dry with a towel.

The creoles of Cuba make a decoction of the leaves of rosemary. This water, they maintain, cleanses, strengthens, and softens the hair.

This also is excellent: Take fifty grammes of the roots of soap-wood boiled in a pint and a half of water. Wash with the hot preparation, then dry the hair and scalp with warm cloths.

The yolk of an egg cleans the head thoroughly and causes the hair to grow. Only the scalp should be rubbed with the yolk, and the head rinsed in hot water. The beaten white of eggs is also recommended as a simple and efficacious preparation for cleansing the hair. Rub the scalp, and rinse in hot water.

The custom of shampooing originated in England. Take one quart of cold or hot water into which is melted thirty grammes of carbonate of soda and fifteen grammes of soap, cut into small pieces. Add a few drops of perfume and thirty grammes of spirits of wine. After washing with this preparation, rinse the hair in warm water. Afterward rub the hair and scalp until dry with warm towels.

The hair should always be thoroughly and rapidly dried. After drying, let it hang loosely on the shoulders for an hour or two if necessary.

Hair, especially gray, may be cleansed with powder. Afterward, it should be carefully brushed. This is an excellent method, though it is difficult to remove the traces of powder from dark hair.

Diseases of the Hair.

Dandruff is not only very disagreeable, but produces baldness. Before resorting to medical treatment for this disease, which is sometimes obstinate, because it depends on a bad state of health, try one of the following simple remedies: First, melt sixty grammes of crystallized soda in a quart of water; add thirty grammes of cologne water. Moisten the hairbrush in the liquid and pass it each day over the affected part. Second, a physician recommends the application of lemon juice to the scalp. Keep the juice as much as possible from the hair. Third, take ten grammes of Panama wood; boil in a pint of rain-water. Wash the affected parts with this decoction two or three times each week.

When the hair falls out without apparent cause, it is diseased. This is the case when the ends split. Sorrow causes the hair to fall out. For this there is no remedy save time and forgetfulness, and happier days.

An animal is known to be unhealthy if its hair is not soft and shiny. It is the same with men and women, and if this is the case it is important to consider the state of the health. A good treatment for hair under these circumstances is to rub the scalp with soap and a mixture of castor-oil, sweet almond, and tannin.

When, after cases of short and severe illness or long-continued ill-health, the hair falls out, as the saying goes, "by the handful," it should be cut quite short and kept clipped for at least a twelvemonth, rubbing the scalp regularly with some wash possessing tonic qualities.

Another point to be carefully noted is the manner of cutting the hair. The weakest and thinnest growth, when the hair has a marked tendency to fall out, is almost invariably along the central parting and about the crown. At these parts, therefore, the hair should be clipped more frequently than anywhere else, and the utmost care should be used to keep the hairs on the top of the head shorter than at the sides and back, where the growth is stronger. Unfortunately, however, the opposite course is generally pursued, the locks at the sides and back being often very closely clipped, while the hair on the crown and along the parting is left quite long.

Grease must never be used; it will fill the pores of the skin and injure the delicate new growth. A weak solution of the essential oils of thyme or rosemary, strong rosemary tea, or ammonia, very much diluted with water, may be rubbed in to stimulate the growth.

Baldness.

Baldness is not so serious a matter to a man as to a woman, for he has the comfort of knowing that he has many companions in his misery.

But a bald woman is really to be pitied. It is impossible to accept such a misfortune with resignation; she must conceal it by every means in her power. She is often compelled to resort to a wig, or to caps such as are worn by dowagers.

The growing tendency to baldness among women has been attributed to the use of hot irons for crimping; to false hair; to overheating the scalp by head-dresses. It is, perhaps, still more due to the use of dyes.

We no longer wait for gray hairs, but vary the color of the hair to suit our caprices, and quite frequently the brunette of to-day may appear to-morrow with golden or even red hair. Those who have black hair sometimes stain it mahogany color. Blondes whose hair is growing darker lighten it by the use of oxygenated water, which removes the color. Many woman will resort to any means rather than allow the hair to grow gray naturally. Such practices are much to be condemned. Let us remain as we are, content to grow old gracefully.

Remedies for Falling Hair.

The juice of a lemon applied to the scalp is said to be a remedy for the falling out of dark hair.

The following recipe has been used successfully: Wash the head each night, rubbing in carefully the following mixture: one teaspoonful of salt and one gramme and a half of quinine, added to a pint of brandy; mix well.

The following remedy has also been used with good results: Steep three common onions in a quart of rum for twenty-four hours; remove the onions and apply the liquor to the scalp every second day. The slight odor of onions soon disappears.

The English medical journal, *The Lancet*, recommends the following pomatum: Tincture of jaborandi, fifteen grammes; lanoline, nine grammes; glycerine, sixty grammes. Mix with a little soft soap, and apply to the scalp every night.

Good results have been also obtained by using walnut leaves steeped in water. Dip a small sponge into the liquid, and moisten the scalp each night. In the morning use the following prescription: Perfumed soft animal fat, sixty grammes; tannin, two grammes; tincture benzoin, six grammes.

After an illness it is unwise to shave the head. The hair will not fall out if cut at intervals of three weeks. Each time a certain quantity must be cut, proportionate to the whole length of the hair; the last cutting should be about to the lobe of the ear. False hair should not be worn, as it sometimes causes total baldness. From the day on which the hair is first cut, the head must be rubbed with a mixture of equal parts of rum and castor-oil. Hot sage tea is also recommended, provided the head is well dried with a warm towel.

Cleansing of Combs and Brushes.

Nothing is better for cleansing brushes than ammonia; it does not soften the bristles, as soap and soda do. Put a teaspoonful of ammonia into a quart of water, and soak the bristles in the solution (keeping the ivory, bone, or varnished back out of the water). The brush must then be rinsed in fresh water and dried in the air, but not in the sun.

Combs should never be washed. They may be cleansed by passing a coarse thread or card between the teeth. There is also a small brush which is used for cleaning combs.

The greatest cleanliness is necessary for all articles used for dressing the hair.

If you use ammonia in your bath, avoid wetting the hair except when necessary, because ammonia fades the hair.

Care of the Eyes.

Never rub the eyes, for this practice causes inflammation of the lids, and however beautiful the expression, if the eyes are red or without lashes, they lose their charm.

Avoid all ointments, washes, etc., not prescribed by a good physician or oculist. It is impossible too strongly to denounce the use of so-called "eye-beautifiers." Many women have ruined their eyes from just such folly.

If the eyelids are inflamed, wash them in rose-water and plantain. The juice of the strawberry strained through a piece of linen is very efficacious.

An old physician has advised the use of elderberry-water for the painful itching sometimes felt in the eyes.

A physician recommends the following prescription: One quart of soft water, a pinch of common salt, a spoonful of brandy. Allow it to dissolve. Shake well before using. This wash will strengthen the sight and restore its powers.

A skillful oculist says that the eyes should be bathed night and morning. Cold water will serve while young, but after middle age use water as hot as the hands can bear; rinse with cold water afterward. This is recommended as a great preservative of the strength of the eyes.

However strong the eyes may be, give them a little rest after a few hours' continuous use. Never force them to gaze at minute objects when they are weak; never read, write, or sew with too dim a light. During all continuous work close the eyes at intervals for a short time. The light should fall from the side or over the shoulder, not full in the face. Never read or write while lying down. Do not read while traveling or walking, or while physically tired. Hygienic conditions, sobriety, the avoidance of all excesses, are rewarded by good eyesight.

Care of the Teeth.

Cleanliness is one of the surest means for overcoming the causes which lead to the destruction of the teeth. They should be carefully brushed night and morning; it is a good practice to rinse the mouth after each meal, if possible; the particles of food which lodge between the teeth decompose and cause, sooner or later, the abominable tartar which is so fatal to teeth.

Some persons use cold water in cleansing the teeth and rinsing the mouth. I advise warm water for both purposes. One should use an infusion of mint or the following mixture: Three grammes of borax and nine grammes of pure glycerine, in a quart of warm water. The first and more simple wash is the better.

It is sufficient to brush the teeth with soap two or three times each week (without interfering with the daily cleansing). For this a very pure soap should be used. It is not an agreeable process, but one soon becomes used to it, and the results are very desirable. Soap contains alkali, and alkalies are highly recommended for the teeth. They are antiseptic, and, therefore, very useful for the mouth. Soap removes the deposits on the teeth, which many of the most famous powders do not, except by destroying the enamel which protects them.

Teeth should not be brushed too long at a time. Doing this injures the gums, and in this way the teeth may be loosened. The upper teeth should be brushed from above downwards (from the gums toward the edges), the lower teeth from below upwards. The inside of the teeth should be as carefully brushed as the outside.

The gums must be well cared for, for when they are healthy there is a better chance that the teeth will be healthy also.

When they are soft the following powder will harden them: Peruvian bark, fifteen grammes; powdered ratanhia, six grammes; chlorate of potassa, five grammes. These powders should be well mixed so as to form but one, with which the gums should be rubbed three or four times daily.

The gums must be gradually accustomed to vigorous friction. When soft, gums bleed easily. They should be washed in an infusion of gentian or blackberry leaves, into which are put a few drops of the tincture of Peruvian bark, or cologne. Lemon juice also has excellent effects on gums which are soft, or even where there is ulceration. Dip a little soft brush in the juice, and carefully pass over the sore places without touching the teeth. Painting the gums with a tincture of ratanhia and the tincture of pyrethrum in equal parts is often recommended. Apply at night.

A decoction of myrrh, tannin, and oak bark is an excellent astringent for tender or bleeding gums.

There are foods which injure the teeth—sugar, sweets, pastry, etc. The abuse of acids destroys the enamel of the teeth. Figs, like sugar, relax and soften the gums; oils, natural fat, or grease, do them no good.

Be careful not to drink anything very cold immediately after swallowing soup. The teeth will suffer from the violent change of temperature.

Care of the Hands.

In doing housework or gardening, old gloves which have lost their freshness and grown large by use may be worn. They will protect the hands from the effects of the air, and keep them clean. Too frequent washing is open to objection, but there are many labors which cannot be performed with covered hands, and in that case they must be washed as often as necessary. A perfectly pure soap should be used. A little almond meal may be put into the warm water in which the hands are washed, and if they are much soiled a little borax or ammonia may be added.

The roughest hands will be softened if care is given them before retiring at night. It scarcely requires five minutes to efface the traces which the rudest labor may have left on the hands. And the necessary articles are not expensive. A nail brush, a box of rose paste, a box of nail powder, a vial of ammonia, almond meal, and French amandine and a lemon are useful.

If a callous spot forms on the inside of the hand it must be rubbed, as patiently and for as long a time as may be necessary, with pumice stone. The operation preserves the softness of the hand and the delicacy of touch.

Stains may be removed by lemon, borax, or ammonia, according to their nature. When the hands have been perfectly cleansed, rub them with French amandine. Wear gloves while sweeping.

If glycerine were not injurious to many skins it would be excellent. The following mixture will be acceptable to those who can use glycerine: The yolk of an egg, six grammes of glycerine, seven grammes of borax. Mix well. Rub the hands with this salve, and cover them with gloves. Almond meal will do as well.

If the hands are very rough, and have been much used, cold-cream may be employed with great advantage at the beginning of the daily treatment which has been suggested. After using for one month the hands will be sufficiently improved to need only almond meal.

Women who do no domestic work may keep their hands white by simply washing them night and morning in bran-water.

Washing the Hands During the Day.

Never have soiled hands, but do not wash oftener than necessary. Lemon juice will remove many stains. If a little salt is added to this juice it is still more efficacious.

A bit of orange or lemon skin removes tar stains. Care must be taken to wipe the hands dry immediately. Fresh tomatoes and strawberries, a leaf of sorrel, a little milk, are excellent for removing ink stains.

Before peeling Irish potatoes, the hands should be well dried, and should not be washed immediately after. By this slight precaution they will not be stained with the juice of the tuber. After paring certain fruits and vegetables a little lemon juice removes all stain. The hands must first be moistened in water.

To cleanse the hands after very rough work use a good emollient or cream. Rub the hands with a small quantity of the emollient, which will penetrate well into the pores of the skin and become incorporated with the greasy substances. Wash the hands in hot water and soap. This treatment make them very soft.

Hands which are "sanctified by labor" may thus retain an agreeable appearance, which is not to be disdained, especially when it is so easily obtained.

Moist hands are unfit for certain kinds of work, and are unpleasant to the touch.

To keep the hands agreeably dry, rub the palms several times each day with a cloth soaked in the following preparation: Cologne water, seventy grammes; tincture of belladonna, fifteen grammes.

Hands which have a tendency to perspire too freely when exposed to the slightest heat may be washed in water in which a little powdered alum has been dissolved.

Sunburned Hands.

At the close of summer, hands which have been kissed too often by the sun are a source of annoyance. The present rage for out-of-door sports, such as croquet, lawn tennis, sailing and rowing, has played havoc with many fair hands. The sunburned hand is in harmony with the life led in summer. On returning to town and resuming laces and silks the contrast is not pleasing. One is tempted too late to regret not having worn gloves.

Time is a certain cure for sunburn. When it is impossible to wait, there are other remedies which it may be well to try; lemon juice and glycerine mixed, or a paste made of corn starch and glycerine, or simply buttermilk. The acidity of the latter is said to remove freckles and sunburn, and the oil contained in it is beneficial and softening to the skin.

Chapped Hands.

For children, and even for many grown persons, winter is the time for chapped hands. It requires but little care to avoid the suffering which results from chapped skin. It is essential that the hands should be thoroughly dried each time they are washed, and never exposed, when moist, either to cold or to the heat of the fire.

Women who are occupied with household cares, who paint, or are engaged in similar occupations, are obliged to wash their hands frequently, and in order to save time they are often careless about drying them; the result is a rough, red skin. Never neglect to dry your hands as thoroughly as possible. They may also be manipulated before the fire until soft and flexible.

Rubbing the hands with amandine before retiring preserves them from the disastrous effects of cold or heat to which they may have been subjected. They must not be washed in cold water, as this predisposes them to chapping, but very hot water is not good for them either. People who have not moist skins should be especially careful to dry the hands thoroughly after washing. They may afterward be covered with cold-cream or amandine, which should be wiped off with a soft towel.

Where these precautions are not taken and the hands are neglected, a cure may be effected by the following treatment: Wash the hands in hot water and anoint them well with amandine, honey paste, or cold-cream. Rub the hands together, interlacing the fingers, until they become soft and are no longer easily hurt when struck against any hard substance. Afterward it will be necessary to remove the grease by washing them in warm water with a few drops of ammonia and a pure soap. Change the water several times. Then apply to the hands the following mixture: Glycerine, cologne, soft water, equal parts. After this process the hands will be soft and not at all greasy or sticky, as might be supposed.

Chilblains.

Chilblains are still more to be feared than chapping. A feeble temperament and bad nourishment are often the causes of this affection. One should walk a great deal, use the hands freely, rub the chilblain parts which are not bleeding with alcoholic preparations, and keep hands and feet very warm.

One would suppose the hands less delicate and less in need of covering than the face. However, everyone knows the necessity of protecting them from the biting cold of frost or wind.

In damp and mild winters chilblains are most painful. There are many remedies for this trouble, which is not dangerous, but the cause of great suffering, and which will deform the prettiest hands in the world.

First.—Pound the bulbs of lilies and place them in a vase containing nut oil. Apply this liniment on the sore places, and cover with a soft cloth. (This is excellent.)

Second.—Honey will cicatrize open chilblains. Anoint the parts affected, and cover with a soft white cloth.

Third.—Poultice the hands at night; rub with the following mixture in the morning: Tincture benzoin, sixty grammes; honey, thirty grammes; water, 210 grammes. Mix well.

Fourth.—Wash ulcerated chilblains with tincture of myrrh diluted with warm water.

Fifth.—Anoint cracked chilblains with Sultana pomatum, and cover with a soft, fine cloth. Cracked chilblains are difficult to cure in winter.

Care of the Nails.

The nails should be cut in a curve which follows the shape of the end of the finger. Their surface should also be polished. One hour a week spent in caring for them is sufficient to keep them in good order, if they are rubbed and cleaned carefully each day.

Never use a steel instrument in cleaning the nails, as it hardens them and causes the dust to accumulate beneath. Nothing is better than the juice of a lemon, which keeps the skin at the base from encroaching on the nail, and also prevents white spots, often caused by lack of care. Cold-cream at night, or French amandine, is excellent for softening the nails, and also prevents them from breaking off and becoming dull.

A manicure set is indispensable for the proper care of the nails. It should consist of an ordinary nail-brush, a still smaller one to go under the nail, a file, a polishing-brush, curved scissors—a pair for each hand; the nails of the right hand cannot be easily cut with scissors made for cutting the nails of the left hand.

Good Taste in Dressing.

The question of dress is one of leading importance in modern society, and the woman who affects indifference to it lacks judgment. A woman who dresses badly loses half her opportunities, that is, if the defects in her toilet are the result of her indifference on the subject. Mme. de Maintenon asserted that good taste indicated good sense.

It was also she who justly blamed women for overtrimming heavy stuffs and wearing ill-chosen ornaments. Nothing can be more ridiculous than ornaments out of place. A gown of cheap material, if well made, is often pretty, though simple and unpretentious.

Short, stout women should never wear gowns of rough, shaggy materials. Skirts made of them fall in stiff and ungraceful folds, and the bodies are equally unbecoming.

Dress fabrics in woolen goods should always be soft to the eye and to the touch. China crêpes, colored silks of medium weight, make charming costumes, and are to be preferred to the stiff silks; but a black silk gown should be of good quality, as an inferior grade does not wear well and soon grows shabby.

Beautiful feathers are durable and graceful ornaments for bonnets; cheap ones are poor economy. Low-priced finery is not worth buying. One should never economize in this way. It is never wise to buy one article of dress noticeably richer than the rest of the wardrobe. For example, a velvet dress is serviceable, but unless one can afford other costumes as elegant, it is out of place.

Mixed cotton and wool goods are usually almost worthless. One all-woolen gown is worth two of them.

Pale-blue is apt to make blondes look ashen. Dark-blue, on the contrary, is very becoming to them, and a blue velvet gown brings out all their delicate coloring. Neutral tints are very unbecoming to them. Brunettes with an inclination to be sallow will do well to avoid blue, as it makes them appear greenish or tawny. Green is trying to them unless they are very fair. It suits blondes perfectly, especially those who have color.

Pale brunettes should affect shades of red, which increase their beauty. Crimson may be worn by blondes. Yellow is a superb contrast for a pale brunette, especially under artificial light, when it is more subdued than in the sunlight. This color softens an olive skin, and borrows from it a creamy tint, harmonizing wonderfully well with dark hair and brilliant eyes. On the contrary, yellow is unbecoming to most blondes.

Concerning Æsthetics.

One must be a pretty and agreeable woman as well as a good wife and mother to keep the husband and father fond of his home. It is often possible to become pretty and agreeable by taking a little pains. Choose for the toilet colors which harmonize with the skin and hair, and wear well-fitting boots and gloves, also pretty home gowns, with sleeves arranged to show to advantage the white and rounded arm.

Do not neglect a daily walk in the fresh air. Without this wholesome exercise it is impossible to retain health and beauty. Use your intelligence to remain pretty or to become so. Add physical to moral and intellectual culture. Superintend your house and busy yourself with your children. This activity of the body, the heart, and the mind, is necessary to those who desire to remain beautiful and beloved.

The Art of Appearing Always Young.

As a charming old lady once said, "To remain always young one must be always amiable."

A melancholy face, a sullen or evil look, is like coming in contact with winter; whereas a serene face, a gracious air, a kind and good expression, are like a spring day, and a smile on the lips like its sunshine.

Sulky people, you may have remarked, always appear to be ten years older than they really are. The face grows wrinkled from contracting the brows; the mouth projects disagreeably when sulking.

Behold beside the portrait of the sullen woman the picture of a sweet and gracious woman: all her features are in repose, her lips form an adorable Cupid's bow, kindness softens her glance, and goodness illuminates her brow.

Perhaps she is the elder, but she will always appear young and charming.

Grace of Movement.

To be graceful, harmony must govern our movements.

There are women who possess in a superior degree the intuition of harmony, who select unconsciously their seats, their poses, according to the toilets which they wear. Dressed in a simple costume, they lean against a piece of furniture of severe style, or sit erect upon an oaken chair, which is in complete harmony with the appearance they present in their tailor-made gowns. In the evening, robed in silks and laces, they as naturally select luxurious sofas, ottomans, and easy-chairs, which are in perfect accord with their costumes. This is not possible for the stiff, angular woman, whose movements are brusque and awkward.

Those who know how to walk and carry themselves possess equilibrium. Perhaps this gift of nature has never been lost by acquiring bad habits, or they have reconquered it by means of study.

If you are inclined to stoop, walk to and fro with your hands behind your back when you are alone in the garden or house,

Children should be taught to throw their shoulders back by being made to walk with elbows close to the body. This will naturally keep the chin free and the chest thrown forward. The back will curve in, the shoulder-blades be kept in their places instead of projecting, the bust will arch itself, and the entire weight of the body be thrown on the hips, which is necessary for a perfect equilibrium.

One should practice touching the ground first with the ball of the foot, to avoid walking on the heels with toes in the air, which is ugly, clumsy, and ungraceful, exposing the whole system to the useless jolting Nature tried to spare us when she formed the ball of the foot.

When mounting a stairway or climbing a hill, for the sake of the lungs as well as to obtain a graceful carriage, both back and head should be held erect.

Grace of Form.

To retain your graceful form, then, learn how to carry yourself. If women would be more careful about this while young, they would have finer figures and more slender hips when older. The woman who holds herself straight, who does not draw her chin to the collar of her garment, who keeps back her shoulder-blades, and thus rounds out her bust, without an apparent effort keeps her muscles firm and flexible and the desired curve in place of flatness. Thus the heaviness which is so much dreaded, and which destroys all youthfulness and grace, may be avoided.

The woman who holds herself well, who throws the weight of her body on her hips (this cannot be too often repeated), instead of allowing it to be supported by the abdomen, has the carriage of a queen, the walk of a nymph. Do not fear that you will acquire a haughty expression. On the contrary, if your eyes are tender and your smile is amiable, your proud grace will not make you unsympathetic.

I do not mean by this that you should carry your head like a peacock, or stiffen yourself, or strut; but hold the bust in the firm and straight position which nature designed, whether you walk, or sit, or stand.

By following this advice you will stoop or lean with a thousand times more grace and flexibility than a woman who relaxes, bends, rounds her back from a mere habit of indifference.

BOOK VI.

EVERY-DAY LAW AND LEGAL FORMS

IMPORTANT USAGES AND PRACTICES—POINTS OF CRIMINAL LAW—IMPORTANT POINTS OF BUSINESS LAW—CONTRACTS AND AGREEMENTS—CO-PARTNERSHIPS—INTEREST LAWS AND STATUTES OF LIMITATIONS—AGENTS AND ATTORNEYS—LANDLORD AND TENANT—LAWS GOVERNING LIENS, ETC.

POINTS IN LAW THAT EVERY ONE SHOULD KNOW

Lease—Form A.

This Agreement, Made between..........*R. B. Congdon*..........
of the County of..........*New Castle*..........and State of..........*Delaware*..........of the first part, and
..........*C. S. Milligan*..........
of..........*Wilmington, Delaware*..........
of the second part, witnesseth: That the said party of the first part has this day leased unto the party of the second part the following described premises, to-wit:
..........*The First Floor and Basement of the Storeroom*..........
..........No..........*Market*..........Street..........
for the term of..........*One Year*..........from and after the..........*first*..........day of
..........*March*..........A.D., 1901......, at the..........*Monthly*..........rent of
..........*Thirty-seven 50-100 Dollars*..........to be paid as follows, to-wit:
..........*On the date of this Lease and on each month thereafter in advance*..........

And it is further agreed that if any rent shall be due and unpaid, demand therefor being waived, or if default be made in any of the covenants herein contained, it shall then be lawful for said party of the first part to re-enter the said premises and remove all persons and property therefrom, or he may recover possession thereof, by action for the forcible detention of said property as provided for in the laws of the state pertaining to rented property.

And the said party of the second part agrees to hire said premises, and to pay the party of the first part therefor the ....*Monthly*..........rent of..........*Thirty-seven 50-100 Dollars*..........
to be paid as follows, to wit:..........*On the date of this lease and on each month thereafter in advance*..........
except when said premises are untenable by reason of fire from any other cause than the carelessness of the party of the second part, or of persons of..........*his*..........family, or in..........*his*..........employ, or by superior force or inevitable necessity

And the said party of the second part covenants that..........*he*..........will use said premises as a..........*storeroom*.......... and for no other purpose whatever; and that..........*he*..........especially will not use said premises nor permit the same to be used for any unlawful business or purposes whatever; that..........*he*..........will not assign this lease or let or underlet said premises without the written consent of the lessor, under the penalty of the forfeiture of all..........*his*..........rights under the lease; and that..........*he*..........will use due care and diligence in guarding said property from damage; that..........*he*..........will keep the same in such repair as the same now are, or may at any time be placed in by the lessor, damages by superior force inevitable necessity, or fire from any other cause than from the carelessness of the lessee, or persons of..........*his*..........family, or in..........*his*..........employ, excepted; and that at the expiration of this lease, or upon a breach by said lessee of any of the covenants herein contained..........*he*..........will, without further notice of any kind, quit and surrender the possession of said premises in as good condition as reasonable use, natural wear and decay thereof will permit, damages by fire as aforesaid, superior force, or inevitable necessity, only excepted.

IN WITNESS WHEREOF, the said parties have hereto subscribed their names on this..........*first*..........
day of..........*March*..........A.D., 1901.

WITNESSES: ....*R. B. Congdon*..........

..........*Charles Worth*.......... ....*C. S. Milligan*..........

..........*Henry Ryan*.......... ....

Lease.—It is important both for the owner of the property and the one who rents it that the agreement be properly and carefully drawn, signed and witnessed. Each party to the agreement should keep a copy duly signed and witnessed.

EVERY-DAY LAW

ITS REQUIREMENTS AND PENALTIES—CRIMINAL LAW—LAWS GOVERNING BUSINESS TRANSACTIONS—THE MAKING OF NOTES—DRAWING LEASES, LANDLORDS AND TENANTS—CONTRACTS OF ALL KINDS—PARTNERSHIPS—CORPORATIONS—POWERS OF AGENTS AND ATTORNEYS—INSURANCE

IMPORTANT USAGES AND PRACTICES

Points of Criminal Law.

Law should be, and is intended to constitute, a rule of right governing the actions of man in his dealings with his fellow-beings.

You cannot lawfully condone an offense by receiving back stolen property.

The exemption of females from arrest applies only in civil, not in criminal matters.

Every man is bound to obey the call of a Sheriff for assistance in making an arrest.

The rule "Every man's house is his castle" does not hold good when a man is accused of crime.

Embezzlement can be charged only against a clerk or a servant, or the officer or agent of a corporation.

Bigamy cannot be proven in law if one party to a marriage has been absent and not heard from for five years.

Grand larceny is when the value of property stolen exceeds $25.00—when less than that, the offense is petit larceny.

Arson to be in the first degree must have been committed at night, and the buildings fired must have been inhabited.

Drunkenness is not a legal excuse for crime, but delirium tremens is considered by the law as a species of insanity.

In a case of assault it is only necessary to prove an "offer or attempt at assault." Battery presumes physical violence.

Mayhem, although popularly supposed to refer to injury to the face, lip, tongue, eye, or ear, applies to any injury done a limb.

A felony is a crime punishable by imprisonment in a State prison; an "infamous" crime is one punishable with death or State prison.

A police officer is not authorized to make an arrest without a warrant unless he has personal knowledge of the offense for which the arrest is made.

An accident is not a crime, unless criminal carelessness can be proven. A man shooting at a burglar and killing a member of his family is not a murderer.

Burglary in the first degree can be committed only in the night time. Twilight, if dark enough to prevent distinguishing a man's face, is the same as "night" in law.

Murder to be in the first degree must be wilful, premeditated, and malicious, or committed while the murderer is engaged in a felonious act. The killing of a man in a duel is murder, and it is a misdemeanor to accept or give a challenge.

False swearing is perjury in law only when willfully done, and when the oath has been legally administered. Such qualifying expressions as "to the best of my belief," "as I am informed," may save an averment from being perjured. The law is that the false statement sworn to must be absolute. Subornation of perjury—that is, inducing another to swear falsely, is a felony.

The penalties which follow the violation of any of the points of criminal law vary slightly in various places, but all include fines or imprisonment, or both. The penalties are intended to be sufficiently severe to deter those evilly disposed from disturbing the peace and happiness of the community.

Important Points of Business Law.

The law compels no one to do impossibilities.

An agreement without consideration is not valid.

Ignorance of the law does not excuse an offender, but it does often influence the mercy of the Court in fixing penalty.

He who conceals a fraud is himself a defrauder.

Signatures made with a lead pencil are good in law.

A receipt for money paid is not legally conclusive.

The act of one partner binds all the others.

The seal of a party to a written contract imports consideration.

A contract made with a minor cannot be enforced against him. A note made by a minor is voidable.

A contract made with a lunatic is void.

A contract made on a Sunday is void.

Principals are liable for the acts of their agents.

Agents are liable to their principals for errors.

Each individual in a partnership is liable for the whole amount of the debts of the firm.

A note which does not state on its face that it bears interest, will bear interest only after maturity.

A lease of land for a longer term than one year is void unless in writing.

An indorser of a note is exempt from liability if notice of its dishonor is not mailed or served within twenty-four hours of its non-payment.

In case of the death of the principal maker of a note, the holder is not required to notify a surety that the note is not paid, before the settlement of the maker's estate.

Notes obtained by fraud, or made by an intoxicated person, are not collectible.

If no time of payment is specified in a note, it is payable on demand.

An indorser can avoid liability by writing "without recourse" beneath his signature.

A check indorsed by the payee is evidence of payment in the drawer's hands.

An outlawed debt is revived should the debtor make a partial payment.

Want of consideration—a common defense interposed to the payment of negotiable paper—is a good defense between the original parties to the paper; but after it has been transferred before maturity to an innocent holder for value it is not a defense.

Negotiable paper, payable to bearer or indorsed in blank, which has been stolen or lost, cannot be collected by the thief or finder, but a holder who receives it in good faith before maturity, for value, can hold it against the owner's claims at the time lost.

Sometimes the holder of a paper has the right to demand payment before maturity; for instance, when a draft has been protested for non-acceptance and the proper notices served, the holder may at once proceed against the drawer and indorsers.

If a note or draft is to be paid in the State where it is made, the contract will be governed by the laws of that State. When negotiable paper is payable in a State other than that in which it is made, the laws of that State will govern it. Marriage contracts, if valid where they are made, are valid everywhere. Contracts relating to personal property are governed by the laws of the place where made, except those relating to real estate, which are governed by the laws of the place where the land is situated.

If a negotiable paper, pledged to a bank as security for the payment of a loan or debt, falls due, and the bank fails to demand payment and to have it protested when dishonored, the bank is liable to the owner for the full amount of the paper.

The expression "Value received" should be written in a note, but it is not necessary. If not written, it is presumed by law, or may be supplied by proof.

No consideration is sufficient in law if it be illegal in its nature. Checks or drafts must be presented for payment without unreasonable delay. Checks or drafts should be presented during business hours; but in this country, except in the case of banks, the time extends through the day and evening.

If the drawer of a check or draft has changed his residence, the holder must use due or reasonable diligence to find him.

If one who holds a check, as payee or otherwise, transfers it to another, he has a right to insist that the check be presented that day, or, at farthest, on the day following.

A note indorsed in blank (the name of the indorser only written) is transferable by delivery, the same as if made payable to bearer.

The maker of an "accommodation" bill or note (one for which he has received no consideration, having lent his name or credit for the accommodation of the holder) is not bound to the person accommodated, but is bound to all other parties, precisely as if there was a good consideration.

An indorsee has a right of action against all whose names were on the bill, when he received it.

A bill, note or draft may be written upon any kind of paper, either with ink or pencil.

An indorsement may be written on the face or back.

An indorser may prevent his own liability to be sued by writing "without recourse," or similar words.

The holder of a note may give notice of protest either to all previous indorsers or only to one of them; in case of the latter he must select the last indorser, and the last must give notice to the last before him, and so on. Each indorser must send notice the same day or the day following. Neither Sunday nor any legal holiday is counted in reckoning time in which notice is to be given.

If the letter containing a protest of non-payment be put into the post-office, any miscarriage does not affect the party giving notice. Notice of protest may be sent either to the place of business or of residence of the party notified.

After the death of a holder of a bill or note, his executor or administrator may transfer it by his indorsement.

The husband who acquires a right to a draft or note which was given to the wife, either before or after marriage, may indorse it.

Written instruments are to be construed and interpreted by law according to the simple, customary and natural meaning of the words used.

The finder of negotiable paper, as of all other property, must make reasonable efforts to find the owner, before he is entitled to appropriate it for his own purposes. If the finder conceal it, he is liable to the charge of larceny or theft.

Joint payees of a bill of exchange, draft or note, who are not partners, must all join in an indorsement.

An oral agreement must be proved by evidence. A written agreement proves itself. The law prefers written to oral evidence, because of its precision.

No evidence can be introduced to contradict or vary a written contract; but it may be received in order to explain it, when such explanation is needed.

Contracts and Agreements.

A contract or agreement is where a promise is made on one side and assented to on the other, or where two or more persons enter into engagement with each other by a promise on either side. In a written contract assent is proved by the signature or mark. In verbal agreements it may be given by a word or a nod, by shaking hands, or by a sign. The old adage, "Silence gives consent," is often upheld in law.

Persons under age are incompetent to make contracts except under certain limitations. Generally minors are incapable of making binding contracts.

There are several causes which void contracts, first among which is *fraud*. No fraudulent contract is binding in law or in equity; but the party defrauded must void the contract as soon as he discovers the fraud. If he continues under the contract after the fraud is discovered he cannot afterwards void it.

SOME IMPORTANT CONTRACT DON'TS.

DON'T enter into an agreement on Sunday unless it is ratified on a week-day.

DON'T make a contract with a person of unsound mind or under the influence of liquor, or otherwise under restraint of liberty, mind or body. Use caution in making contracts with an illiterate, blind or deaf and dumb person, and see to it that witnesses are present.

DON'T put a forced construction on a contract —the intent of the parties is a contract.

DON'T suppose that you can withdraw a proposition made in writing and sent by mail after the party to whom it was made has mailed an unconditional acceptance.

DON'T suppose that a conditional acceptance of a proposition is binding on the party making the proposition.

DON'T forget that the courts will construe a contract according to the law prevailing where it was made.

DON'T forget that the law says, "no consideration, no contract," and that the courts will not enforce a contract that is too severe in its provisions.

DON'T sign an agreement unless you have carefully weighed its provisions, which should be all fixed and certain.

Copartnerships.

Partnerships may be either general or special. In general partnerships money invested ceases to be individual property. Each member is made personally liable for the whole amount of debts incurred by the company. The company is liable for all contracts or obligations made by individual members.

Special partners are not liable beyond the amount contributed.

A person may become a partner by allowing people generally to presume that he is one, as, by having his name on the sign or parcel or in the bills used in the business.

A share or specific interest in the profits or loss of a business, as remuneration for labor may involve one in the liability of a partner.

In case of bankruptcy, the joint estate is first applied to the payment of partnership debts, the surplus only going to the creditors of the individual estate.

A dissolution of partnership may take place under express stipulations in the articles of agreement, by mutual consent, by the death or insanity of one of the firm, by award of arbitrators, or by court of equity in cases of misconduct of some member of the firm.

INTEREST LAWS AND STATUTES OF LIMITATIONS.

STATES AND TERRITORIES.	INTEREST RATE.		STATUTES OF LIMITATIONS.		
	Legal Rate.	Rate Allowed by Contract.	Judgments, Years.	Notes, Years.	Open Accounts, Years.
	per ct.	per ct.			
Alabama	8	8	20	6	3
Arkansas	6	10	10	5	3
Arizona	7	Any rate.	5	5	3
California	7	Any rate.	5	4	2
Colorado	8	Any rate.	10	6	6
Connecticut	6	†	...	6	6
Delaware	6	6	20	6	3
District of Columbia	6	10	12	3	3
Florida	8	10	20	5	2
Georgia	7	8	7	6	4
Idaho	7	12	6	(*j*)	4
Illinois	(*j*)	7	20	10	5
Indiana	6	8	20	10	6
Iowa	6	8	20	10	5
Kansas	6	10	5	5	3
Kentucky	6	6	15	15	5
Louisiana	5	8	10	5	3
Maine	6	Any rate.	20	6	6
Maryland	6	6	12	3	3
Massachusetts	6	Any rate.	20	6	6
Michigan	5	7	6	6	6
Minnesota	6	10	10	6	6
Mississippi	6	10	7	6	3
Missouri	6	8	10	10	5
Montana	10	Any rate.	10	8	3
Nebraska	7	10	5	5	4
Nevada	7	Any rate.	6	5	4
New Hampshire	6	6	20	6	6
New Jersey	6	6	20	6	6
New Mexico	6	12	7	6	6
New York	6	6	20	6	4
North Carolina	6	6	10	3	3
North Dakota	7	12	10	6	6
Ohio	6	8	5	15	6
Oklahoma	7	12	5	5	3
Oregon	6	10	10	6	6
Pennsylvania	6	6	5	6	6
Rhode Island	6	Any rate.	20	6	6
South Carolina	7	8	10	6	6
South Dakota	7	12	10	6	6
Tennessee	6	Any rate.	10	6	6
Texas	6	10	10	6	4
Utah	8	Any rate.	8	6	4
Vermont	6	6	8	6	6
Virginia	6	6	20	5	2
Washington	7	12	6	6	3
West Virginia	6	6	10	10	3
Wisconsin	6	10	20	6	6
Wyoming	8	12	5	5	8

New York has by a recent law legalized any rate of interest on call loans of $5000 or upward, on collateral security. †No usury, but over 6 per cent. cannot be collected by law.

A partner signing his individual name to negotiable paper, which is for the use of the partnership firm, binds all the partners thereby. Negotiable paper of the firm, even though given on private account by one of the partners, will hold all the partners of the firm, when it passes into the hands of the holders, who are ignorant of the fact attending its creation.

Partnership effects may be bought and sold by a partner; he may make contracts; may receive money; indorse, draw and accept bills and notes, and, while this may be for his own private account, if it apparently be for the use of the firm, his partners will be bound by his action, provided the parties dealing with him were ignorant of the transaction being on his private account; and thus representation or misrepresentation of a partner, having relation to business of the firm, will bind the members in the partnership.

In case of death, the surviving partner must account to the representatives of the deceased.

Agents and Attorneys.

An agent or an attorney is one authorized by a person to act for him and in his stead, in the transaction of business for the person appointing said agent or attorney.

In regard to the subject of an agency, the general rule is, that whatever a man may do in his own right he may also transact through another. Things of a personal nature, implying personal confidence on the part of the person possessing them, cannot be delegated.

Infants, married women, lunatics, idiots, aliens, belligerents, and persons incapable of making legal contracts, cannot act as principals in the appointment of agents. Infants and married women may, however, become principals in certain cases.

The act of the agent always binds his principal. Agents who exceed their authority, become themselves personally responsible to their principals.

One should not consent to act as an agent or attorney in complicated matters, except where the powers of this office be explicitly defined in writing.

Agency may be terminated in two ways: (1) by the act of the principal or agent; (2) by operation of law. In the latter case, the termination of the agency is effected by lapse of time, by completion of the subject-matter of the agency, by the extinction of the subject-matter, or by the insanity, bankruptcy or death of either party.

Landlord and Tenant.

Leases for one year or less need no written agreement. Leases for more than a year must be in writing; if for life, signed, sealed, and witnessed in the same manner as any other important document.

Leases for over three years must be recorded. No particular form is necessary.

If no agreement in writing for more than a year can be produced, the tenant holds the property from year to year at the will of the landlord. If there is no agreement as to time, the tenant as a rule holds from year to year.

A tenancy at will may be terminated by giving the tenant one month's notice in writing, requiring him to remove from the premises occupied.

A tenant is not responsible for taxes, unless it be so stated in the lease.

The tenant may underlet as much of the property as he desires, unless it is expressly forbidden in the lease. Tenants at will cannot underlet.

A married woman cannot lease her property under the common law, but this prohibition is removed by statute in most of the States. A husband cannot make a lease which will bind his wife's property after his death.

A lease made by a minor is not binding after the minor has attained his majority. It binds the lessee, however, unless the minor should release him. Should the minor receive rent after attaining his majority, the lease will be therefore ratified. A lease given by a guardian will not extend beyond the majority of the ward.

A new lease renders void a former lease.

In case there are no writings, the tenancy begins from the day possession is taken; where there are writings and the time of commencement is not stated, the tenancy will be held to commence from the date of said writings.

Leases on mortgaged property, whereon the mortgage was given prior to the lease, terminate when the mortgage is foreclosed.

Where a tenant assigns his lease, even with the landlord's consent, he will remain liable for the rent unless his lease is surrendered or cancelled.

A building erected by tenants on foundations sunk into the ground, becomes a part of the realty, and belong to the landlord. Improvements to the building rented, that are nailed or screwed to the building become the property of the landlord. But trade fixtures belong to the tenant, it being presumed when the building is rented for trade purposes that it is permissible to put in the fixtures or make necessary attachments of same to the building. Among our business forms will be found a correct form of lease. Care must be taken in filling necessary blanks, and in ruling lines in spaces not filled by words.

Laws Governing Liens.

In all the States and Canada it is the object of the law to protect the mechanic and laboring man and also the merchant. Hence there are laws in the several States for this purpose. While the general trend is the same, the laws vary in details. It is not difficult to procure a copy of the laws, which every builder and householder should do. Any contractor, sub-contractor or laborer who performs any work, or furnishes any materials, in pursuance of, or in conformity with, any agreement or contract with the owner, lessee, agent or one in possession of the property, toward the erection, altering, improving or repairing of any building, shall have a lien for the value of such labor or materials on the building or land on which it stands to the extent of the right, title and interest of the owner, lessee or person in possession at the time of the claimant's filing his notice with the Clerk of the County Court. Such lien is called a mechanic's lien.

The notice should be filed within thirty days after completion of the work or the furnishing of the materials, and should state the residence of the claimant, the amount claimed, from whom due, when due, and to whom due, the name of the person against whom claimed, the name of the owner, lessee or person in possession of the premises, with a brief description of the latter.

Liens cease in one year after the filing of the notice, unless an action is begun, or the lien is continued by an order of Court.

The following classes of persons are generally entitled to lien: 1. Bailees, who may perform labor and services, on the thing bailed, at the request of the bailor. 2. Innkeepers, upon the baggage of guests they have accommodated. 3. Common carriers, upon goods carried, for the amount of their freight and disbursements. 4. Vendors, on the goods sold for payment of the price where no credit has been expressly promised or implied. 5. Agents, upon goods of their principals, for advancements for the benefit of the latter. 6. All persons are entitled to the right of lien who are compelled by law to receive property and bestow labor or expense on the same.

The right of lien may be waived: 1. By express contract. 2. By neglect. 3. By new agreement. 4. By allowing change of possession. 5. By surrendering possession.

The manner of the enforcement of a lien, whether it be an innkeeper's, agent's, carrier's, factor's, etc., depends wholly upon the nature and character of the lien.

Perishable property on which a lien is held may be sold, and the lien attaches to the proceeds.

Liens take precedence according to priority, and interest on a judgment on a prior lien must also be satisfied before a subsequent lien may be realized upon.

What a Copyright Protects.

A title may be entered, but the copyright covers the book and not the title. A title alone cannot be copyrighted; it can be protected solely as a trade mark. What is a copyrighted manuscript? Copyright pertains to a published book only. So long as a book is in manuscript it is protected by a common law of property; no one can print it without authority unless he steals it. It is when a book is published that the copyright law steps in to protect it. Every day we have evidence that authors have wrong notions of copyright; they make a point of having obtained copyright as if it were something difficult—like a patent—and think they have in some way secured their book and their title by entering the latter.

BOOK VII.

EVERY-DAY COMPENDIUM OF REMARKABLE FACTS

A BOOK OF VALUABLE INFORMATION, GATHERED FROM ALL SOURCES, AND CONVENIENTLY ARRANGED—INCLUDING THE FIRST THINGS, THE GREATEST THINGS, THE WONDERFUL AND MARVELOUS IN HISTORY, SACRED AND PROFANE—STRIKING FACTS OF LITERATURE, ART AND SCIENCE—STATISTICS AND TABLES FROM LATEST CENSUS REPORT.

INFORMATION FOR ALL

FACTS FOR THE CURIOUS

REMARKABLE THINGS—PERSONAGES AND EVENTS IN THE WORLD'S ANNALS—IMPORTANT FACTS AND FIGURES FOR EVERY DAY USE —BOOKS, LITERATURE, ART AND ARTISTS—FACTS ABOUT THE BIBLE—SACRED BOOKS AND RELIGIONS

THINGS WORTH KNOWING

The Seven Bibles of the World.

The chief sacred books of the world are the Scriptures of the Christians, the Tripitaka of the Southern Buddhists, the Five Kings of the Chinese, the three Vedas of the Hindoos, the Koran of the Mohammedans, the Zendavesta of the Parsees, and the Eddas of the Scandinavians.

The Koran is the most recent, having been written in the seventh century after Christ. It contains many excerpts from the Old and New Testaments and the Talmud.

The Tripitaka contains sublime morals and pure aspirations. The author lived and died in the sixth century before Christ.

The Five Kings contain wise sayings on the duties of life. The word "King" in the Chinese language means web of cloth. From this it is presumed that they were originally written on five rolls of cloth. They were written by a number of wise men some time not earlier than the eleventh century before Christ.

The Vedas can not be proven to antedate the twelfth century before the Christian era.

The Zendavesta is regarded among scholars as being the greatest and most learned of all sacred writings, excepting the Christian Bible. It was written by Zoroaster in the twelfth century before Christ.

The Eddas, a semi-sacred work of the Scandinavians, was first given to the world in the fourteenth century but is probably much older.

Moses is claimed to have written the Pentateuch at least 1,500 years before Christ; if so, that portion of the Christian Bible is at least 300 years older than any other sacred writings.

The Nine Religions of the World.

There are estimated to be 1,000 forms of religious worship practiced in the world. The following table shows the nine grand divisions or creeds, which are each subdivided into numerous sects:

	Creeds.	No. of Followers.
1.	Christianity	500,000,000
2.	Worship of Ancestors and Confucianism	256,000,000
3.	Hinduism	190,000,000
4.	Mohammedanism	180,000,000
5.	Buddhism	147,900,000
6.	Taoism	43,000,000
7.	Shintoism	14,000,000
8.	Judaism	8,000,000
9.	Polytheism	117,681,669

Distribution of the People of the Christian Religion.

The leading faiths are represented by these figures: Protestant Christians, 200,000,000: Roman Catholic Christians, 195,000,000; Greek Catholic Christians, 105,000,000; non-Christians, 1,000,000,000.

The Name of God in Forty-Eight Languages.

Hebrew	Eleah, Jehovah
Chaldaic	Eiliah
Assyrian	Eleah
Syrian and Turkish	Alah
Malay	Alla
Arabic	Allah
Languages of the Magi	Orsi
Old Egyptian	Teut
Armenian	Teuti
Modern Egyptian	Teun
Greek	Theos
Cretan	Thios
Aedian and Dorian	Ilos
Latin	Deus
Low Latin	Diex
Celtic Gaelic	Diu
French	Dieu
Spanish	Dios
Portuguese	Deos
Old German	Diet
Provincial	Dion
Low Breton	Done
Italian	Dio
Irish	Dia
Olotu tongue	Deu
German and Swiss	Gott
Flemish	God
Dutch	God
English	God
Teutonic	Goth
Danish and Swedish	Gud
Norwegian	Gud
Slav	Buch
Polish	Bog
Polacca	Bung
Lapp	Jubinal
Finnish	Jumala
Runic	As
Zemblian	Fetiza
Pannonian	Istu
Hindostanee	Rain
Coromandel	Brama
Tartar	Magatai
Persian	Sire
Chinese	Prussa
Japanese	Goezer
Madagascar	Zannar
Peruvian	Puchecammae

Mankind Naturally Religious.

All men, wherever found, worship some higher power. Among the most savage races there exists some conception of a deity. Beginning with Fetishism—the worship of animals, trees, insects, etc.—the religious ideas advanced into personification and symbolism, and produced Idolatry or Paganism, and was an element of early civilization. From this, in different lands, and among different races of men, diverged notions of religious theology, which eventually worked themselves into systems, generally based upon a personality, or individual Godhead or mediator. The chief religions of the world are the Jewish, the Christian, the Mohammedan, the Brahman, the Buddhistic and the Zoroastrian. Buddhism has the most followers and Christianity next. Brahmanism and Mohammedanism each have a little more than one-fourth as many as Christianity. The Jewish religion comes next, and the Zoroastrians or Fire-worshippers the smallest number. It is not possible to attempt to do more than outline the different faiths.

The Jewish Religion is the oldest of all organized forms of worship. And the teachers of its tenets have influenced the Jewish people, keeping their stock pure and unmixed though they are scattered in all countries.

In their religious observances modern Jews adhere to the rules of the Mosaic dispensation. Their service consists chiefly in reading the law in their synagogues, together with a variety of prayers. They abstain from the meats prohibited by the Levitical law, and they continue to observe the ceremonies of the Passover, as nearly as possible. They offer prayers for the dead, because they believe that the souls of the wicked go to a place of temporary punishment, where they remain under trial a year, and they think that very few will be condemned to suffer eternally. We give a summary of the confession of faith, in which all orthodox Jews must live and die. It is made up of thirteen articles, and was drawn up in the eleventh century by a celebrated rabbi named Maimonides. These articles declare in substance: (1) That there is one God, creator of all things, who may exist without any part of the universe, but without whom nothing can maintain existence; (2) that God is uncompounded and indivisible, but different from all other unities; (3) that God is an immaterial being, without any admixture of corporeal substance; (4) that God is eternal, but everything else had a beginning in time; (5) that God alone ought to be worshipped, without mediators or intercessors; (6) that there have been inspired prophets, and may be more; (7) that Moses was the grandest prophet that ever appeared; (8) that the law of Moses was in every syllable dictated by the Almighty, not only in its written letter but in traditionary exposition; (9) that this law is immutable, neither to be added to nor diminished; (10) that God knows all our actions and governs them as He will; (11) that the observance of the law is rewarded and its violation punished in this world, but in a greater degree in the next; (12) that a Messiah is yet to appear, the time of whose coming may not be prescribed or foretold; and (13) that God will raise the dead at the last day and pass judgment upon all.

Fire-Worshippers.—The Parsees are at present the only devotees of Zoroaster, who is supposed to have founded the religion of the Fire-Worshippers about one thousand years before Christ. Its doctrines are set forth in the Zendavesta, the sacred books of the Parsees, who are supposed to have been the "Magi" of the Scriptures. Like the Koran of Mohammed, the Zendavesta is made up of the so-called inspired visions of the prophet Zoroaster, who preached Monotheism (one God), added to which were the principles of Good and Evil, having power over Men, the Good being recognized in the blazing flame, the Evil in the burned-out wood or charcoal; Night and Day, Sleeping and Waking, Death and Life. The Fire-Worshippers believed in the resurrection of the body, and held the idea of a Messiah, who was to be the awakener and mediator; they also recognized the doctrine of future rewards and punishments, and the efficacy of the prayers of the Good, who would become immortal, while for the wicked the end was annihilation.

Buddhism is the religion of China, Japan, the Malay Peninsula, and the Polynesian Islands, and governs the largest number of souls of any existing faith. Buddhism originated in northern Hindustan, in the sixth century B. C., and was founded by a Prince Siddhartha, Gautama, or Sakya (see Arnold's "Light of Asia"). To this prince, after the period of his ascetic and mendicant life, was given the name "Buddha," meaning, "he to whom truth is known," and from which is derived the name of the sect. The Buddhist faith is based upon belief in the doctrine of the transmigration of souls, by which every individual changes the nature of his existence at death, for better or for worse, in accordance with his behavior during that existence, being thus exalted or degraded, through all imaginable forms, from a clod to a divinity. This faith accepts no ultimate creator, and only finds final rest or happiness in annihilation.

Mohammedanism.

Though founded nearly 600 years after Christianity, Mohammedanism is a religion of the sword, conquering the mind and body rather than winning the heart.

The Mohammedan religion was started by Mohammed, of the tribe of Koreish, who was born in Mecca in 570 A. D., though it was not until he had reached his fortieth year that he first discovered the gift of prophecy, and began to see visions. He thereafter preached the doctrines which he claimed to have received by direct inspiration, and which are contained in the Koran, of which translations in French, English, and German can be found in the public libraries. Mohammedanism is made up of parts of Judaism and Christianity, the theory of its founder being that he was one (but the greatest) of a series of prophets, including both Abraham and Christ. It comprises belief in one God—"there is no God but God, and Mohammed is God's Apostle." It also peoples the unknown universe with angels—good and evil, and accepts the resurrection and the final judgment. It establishes a Paradise and seven Hells, the lowest and deepest of which is for the "Hypocrites: those who, outwardly professing a religion, in reality had none." The Mohammedan belief further recognizes the inutility of "works" in influencing the final condition of man, assuming that it is not by these, but by God's mercy, that he is saved, and not damned. Predestination is a part of the creed, man's whole life and destiny being prefigured by Fate (Kismet). The efficacy of prayer is, however, established, and this form of worship enjoined upon "the Faithful;" this, with the sensual nature and characteristics of the Mohammedan Paradise, completes a superficial view of the peculiarities of this religion, as presented in the Koran.

Fetishism is still practiced by certain tribes in Africa and by the Indians of the Arctic regions of America.

Curiosities of the Bible.

There is no date from beginning to end in the Bible. It comprises sixty-six documents, or books and is supposed to have been written by about forty men; The Book of Isaiah has sixty-six chapters; fifty-four miracles are recorded in the Old and fifty-one in the New Testament; total 105. The shortest verse in the Old Testament is "Remember Lot's wife." The shortest one in the New Testament is John xi. 35, "Jesus wept," in point of words, but not in letters, another verse is as short, viz: Thessalonians v. 16, "Rejoice evermore." The longest verse is the ninth verse of the eighth chapter of Esther. Then there is one book, Esther, in which the Deity is not mentioned.

The Bible contains 3,566,480 letters, 773,746 words, 31,173 verses, 1,189 chapters and sixty-six books. The word "and" occurs 46,277 times. The word "Lord" occurs 1,855 times. The word "Reverend" occurs but once, which is in the ninth verse of the 111th Psalm. The middle verse is the eighth verse of the 118th Psalm. The 21st verse of the seventh chapter of Ezra contains all the letters of the alphabet, except the letter J. There are no words or names of more than six syllables.

A Description of Mount Ararat.

Ararat is divided into two peaks, Great Ararat on the northwest and Little Ararat on the southwest, whose bases blend while their summits are seven miles apart. The summit of Great Ararat is placed at 17,323 feet above the level of the sea, and 14,320 above its base; and for more than 3,000 feet below the summit it is always covered with ice and snow. Little Ararat is 13,000 feet above the sea level. The apex of Great Ararat was visited by Parrot, October 9, 1829. Dr. Schaff, in common with Smith, says that Ararat in Scripture refers to the lofty plateau or mountain-highlands which overlook the plain of the Araxes. The same authority states that the mountains of Ararat (Gen. viii. 4) more properly refer to the entire range of elevated tableland in that portion of the Armenia, and that upon some lower part of this range, rather than upon the high peaks, the ark more probably rested; and the following reasons are given in support of this view: This plateau or range is about 6,000 or 7,000 feet high; it is equally distant from the Euxine and the Caspian Seas, and between the Persian Gulf and the Mediterranean, and hence a central point for the dispersion of the race; the region is volcanic in its origin, does not rise into sharp crests, but has broad plains separated by subordinate ranges of mountains; and the climate is temperate, grass and grain are abundant, and the harvests are quick in nature. These facts, he believes, illustrate the Bible narrative.

New Testament Chronology.

First published in 1899 by Zahn, the greatest of German Biblical scholars.

	YEAR A. D.
Death and resurrection of Christ . .	30
Events recorded, Acts i–viii. . . .	1–34
Conversion of St. Paul	35
Three years' sojourning of Paul in Damascus, interrupted once by a journey to Arabia, flight from Damascus. First visit to Jerusalem, and stay at Tarsus	38
Peter at Joppa and Cæsarea, ...	10
Luke a church member at Antioch, Paul brought from Tarsus to	

Antioch, by Barnabas, either the summer or autumn of	43
Death of James, son of Zebedee. Imprisonment of Peter. Flight of the latter and other prophets from Jerusalem	44
Visit of Peter and others from Jerusalem to Antioch. Letter of St. James	50
First mission tour of Paul, spring 50 to fall	51
Apostles convene in Jerusalem, beginning of	52
Start of second mission tour of St. Paul, spring of	52
Arrival at Corinth, about November,	52
Epistle to the Galatians, beginning of	53
First Epistle to the Thessalonians, spring of	53
Second Epistle to the Thessalonians, summer	53
Journey from Corinth to Ephesus, before Pentecost, about May	54
Beginning of the third mission tour from Antiochia to Ephesus, probably summer	54
Arrival at Ephesus, about February,	55
Short visit to Corinth, from Ephesus. Last Epistle of St. Paul to the Corinthians, end of 56 or beginning of	57
Letter of the Corinthians to St. Paul. First Epistle of Paul to the Corinthians, Easter	57
Departure of Paul and Timothy from Ephesus by way of Troas to Macedonia, about or after Pentecost	57
Second Epistle to the Corinthians, about November or December	57
Journey of Paul from Macedonia to Corinth, about New Year	58
Epistle to the Romans during a three months' stay in Greece and Corinth	58
Journey by way of Macedonia, Troas, Miletus, etc., to Jerusalem, and beginning of Captivity in Cæsarea.	58
Defense before Festus	60
Departure from Cæsarea, September.	60
Arrival at Rome, March	61
Epistles to the Ephesians, Collossians, and Philemon, summer of	62
Second Epistle of St. Peter	62
Matthew writes his Aramaic Gospel.	62
Epistle to Philippians, summer of	63
Paul free again, late in summer of	63
Journey of Paul to Spain, fall 63 or spring	64
Arrival of Peter in Rome, fall 63 or spring	64
First Epistle of Peter, spring of	64
Mark in Rome, engaged on the completion of his Gospel, summer of	64
Persecution under Nero and crucifixion of Peter, fall of	64
Return of Paul from Spain and visitation of the Eastern congregation, I Timothy and Titus, spring to fall	65
of Stay at Nicopolis, winter of	65–66
Return of Paul to Rome, spring of	66
Arrest of Paul. II Timothy; summer of	66
Paul beheaded, end of 66 or beginning of	67
Publication of Gospel of Mark, beginning	67
Departure of St. John and other Apostles to the province of Asia, beginning of	68
Epistle of Jude, beginning	75
Gospel and Acts of St. Luke, beginning	75
Epistle to the Hebrews, beginning	80
Origin of the Greek Matthew, beginning	85
Gospel and the Epistles of John, between	80–90
Apocalypse of St. John, beginning	95
Death of St. John, beginning	100

Supposed Fate of the Apostles.

The following brief history of the fate of the Apostles may be new to those whose reading has not been evangelical:

St. Matthew is supposed to have suffered martyrdom, or was slain with the sword in a city of Ethiopia.

St. Mark was dragged through the streets of Alexandria, in Egypt, till he expired.

St. Luke was hanged upon an olive tree in Greece.

St. John was put in a caldron of boiling oil at Rome and escaped death. He afterward died a natural death at Ephesus in Asia.

St. James the Great was beheaded at Jerusalem.

St. James the Less was thrown from a pinnacle or wing of the temple and then beaten to death with a fuller's club.

St. Philip was hanged up against a pillar at Hieropolis, a city of Phrygia.

St. Bartholomew was flayed alive by the command of a barbarous king.

St. Andrew was bound to a cross, whence he preached unto the people till he expired.

St. Thomas was run through the body with a lance at Coromandel, in the East Indies.

St. Jude was shot to death with arrows.

St. Simon Zealot was crucified in Persia,

St. Matthias was first stoned and then beheaded.

St. Barnabas was stoned to death by Jews at Salania.

St. Paul was beheaded at Rome by the tyrant Nero.

ABOUT BOOKS AND WRITERS OF BOOKS

Names for Different Sizes of Books.

The name indicates the number of pages in the sheet, thus: In a folio book, 4 pages or 2 leaves = 1 sheet; a quarto. or 4to., has 8 pages or 4 leaves to a sheet; an octavo, or 8vo., 16 pages or 8 leaves to a sheet. In a 12mo., 24 pages or 12 leaves = 1 sheet, and the 18mo., 36 pages or 18 leaves = 1 sheet, and so on. The following are the approximate sizes of books:

Royal Folio	19	inches	× 12
Demy	18	"	× 11
Super Imp. Quarto (4 to)	15½	"	× 13
Royal 4to	12½	"	× 10
Demy 4to	11½	"	× 8½
Crown 4to	11	"	× 8
Royal Octavo	10½	"	× 6½
Medium 8vo.	9½	"	× 6
Demy 8vo.	9	"	× 5½
Crown 8vo.	7½	"	× 4½
Foolscap 8vo.	7	"	× 4
12mo.	7	"	× 4
16mo.	6½	"	× 4
Square 16mo.	4½	"	× 3½
Royal 24mo.	5½	"	× 3¼
Demy 24mo.	5	"	× 2¾
Royal 32mo.	5	"	× 3
Post 32mo.	4	"	× 2½
Demy 48mo.	3¼	"	× 2¼

Assumed Names of Well-known Writers.

Many of the greatest men and women of the literary world have placed upon the title pages of their books, and signed their contributions with an assumed name, or *nom de plume*. The following table will identify most of such authors of note. For convenience, the men and women writers are entered on separate lists:

NOM DE PLUME.	REAL NAME.
A Country Parson,	Archbishop Whately.
Agate,	Whitelaw Reid.
Alfred Crowquill,	A. H. Forrester.
Americus,	Dr. Francis Lieber.
Artemus Ward,	Charles F. Browne.
Asa Trenchard,	Henry Watterson.
Barry Cornwall,	Bryan Walter Proctor.
Benauly,	Benjamin Austin, and Lyman Abbott.
Besieged Resident,	Henry Labouchere.
Bill Arp,	Charles H. Smith.
Blythe White, Jr.,	Solon Robinson.
Bookworm,	Thomas F. Donnelly.
Boston Bard,	Robert S. Coffin.
Boz,	Charles Dickens.
Brick Pomeroy,	Mark M. Pomeroy.
Burleigh,	Rev. Matthew Hale Smith.
Burlington,	Robert Saunders.
Carl Benson,	Charles A. Bristed.
Chartist Parson,	Rev. Charles Kingsley.
Chinese Philosopher,	Oliver Goldsmith.
Chrystal Croftangry,	Sir Walter Scott.
Country Parson,	A. K. H. Boyd.
Danbury Newsman,	J. M. Bailey.
Diedrich Knickerbocker,	Washington Irving.
Dow, Jr.,	Elbridge G. Page.
Dr. Syntax,	William Combe.
Dunn Browne,	Rev. Samuel Fiske.
Edmund Kirke,	James Roberts Gilmore.
Elia,	Charles Lamb.
Eli Perkins,	Matthew D. Landon.
English Opium-Eater,	Thomas DeQuincey.
Ettrick Shepherd,	James Hogg.
Eugene Pomeroy,	Thomas F. Donnelly.
Falconbridge,	Jonathan F. Kelly.
Fat Contributor,	A. M. Griswold.
Father Prout,	Francis Mahoney.
Frank Forrester,	Henry W. Herbert.
Gath, also Laertes,	George Alfred Townsend.
Geoffrey Crayon,	Washington Irving.
George Fitzboodle,	William M. Thackeray.
George Forest,	Rev. J. G. Wood.
Hans Breitmann,	Charles Godfrey Leland.
Hans Yokel,	A. Oakley Hall.
Harry Hazell,	Justin Jones.

NOM DE PLUME.	REAL NAME.
Harry Lorrequer,	Charles Lever.
Hibernicus,	De Witt Clinton.
Historicus,	William G. Vernon Harcourt.
Hosea Bigelow,	James Russell Lowell.
Howadji,	George William Curtis.
Howard,	Mordecai Manuel Noah.
Hyperion,	Josiah Quincy.
Ik Marvel,	Donald G. Mitchell.
Irenæus,	Rev. S. Irenæus Prime, D. D.
Isabel,	William Gilmore Simms.
Janus,	Dr. Dollinger.
Jay Charlton,	J. C. Goldsmith.
Jedediah Cleishbotham,	Sir Walter Scott.
John Chalkhill,	Izaak Walton.
John Darby,	J. C. Garretson.
John Paul,	C. H. Webb.
John Phœnix, Gentleman,	George H. Derby.
Josh Billings,	Henry W. Shaw.
Joshua Coffin,	H. W. Longfellow.
Kirwan,	Rev. Nicholas Murray.
K. N. Pepper,	James M. Morris.
Laicus,	Rev. Lyman Abbott.
Launcelot Wagstaffe, Jr.,	Charles Mackay.
Lemuel Gulliver,	Jonathan Swift.
Major Jack Downing,	Seba Smith.
Mark Twain,	Samuel L. Clemens.
Max Adler,	Charles H. Clark.
M. Quad,	Charles B. Lewis.
Mrs. Partington,	B. P. Shillaber.
M. T. Jug,	Joseph Howard.
Ned Buntline,	Edward Z. C. Judson.
Nym Crinkle,	A. C. Wheeler.
Old Bachelor,	George William Curtis.
Old Cabinet,	R. Watson Gilder.
Old Humphrey,	George Mogridge.
Old 'Un,	Francis Alexander Durivage.
Oliver Optic,	William Taylor Adams.
Ollapod,	Willis G. Clark.
Orpheus C. Kerr,	Robert H. Newell.
Owen Meredith,	Lord Lytton.
Parson Brownlow,	Wm. Gunnaway Brownlow.
Paul Creyton,	J. T. Trowbridge.
Pen Holder,	Rev. Edward Eggleston.
Pequot,	Charles W. March.
Perley,	Benj. Perley Poore.
Peter Parley,	S. C. Goodrich.
Peter Pindar,	Dr. John Wolcot.
Petroleum V. Nasby,	D. R. Locke.
Phœnix,	Sir Henry Martin.
Poor Richard,	Benjamin Franklin.
Porte Crayon,	David H. Strother.
Private Miles O'Reilly,	Charles G. Halpine.
Robinson Crusoe,	Daniel Defoe.
Runnymede,	Lord Beaconsfield.
Rustic Bard,	Robert Dinsmore.
Sam Slick,	Thomas C. Halliburton.
Sparrowgras,	F. S. Cozzens.
Teufelsdroeckh,	Thomas Carlyle.
Teutha,	William Jerdan.
The Black Dwarf,	Thomas J. Wooler.
The Celt,	Thomas Davis.

NOM DE PLUME.	REAL NAME.
The Druid,	Henry H. Dixon.
The Governor,	Henry Morford.
The Traveller.	Isaac Stary.
Theodore Taylor,	J. C. Hotten.
Thomas Ingoldsby,	Rev. R. H. Barham.
Thomas Little,	Thomas Moore.
Thomas Rowley,	Thomas Chatterton.
Timon Fieldmouse,	William B. Rands.
Timothy Tickler,	Robert Syme.
Timothy Titcomb,	Dr. J. G. Holland.
Tom Brown,	Thomas Hughes.
Tom Folio,	Joseph E. Babson.
Tom Hawkins,	Theodore W. A. Buckley.
Trinculo,	John A. Cockerill.
Tristam Merton,	Thomas B. Macaulay.
Two Brothers,	A. and C. Tennyson.
Ubique,	Parker Gilmore.
Uncle Hardy,	William Senior.
Uncle John,	Elisha Noyce.
Uncle Philip,	Rev. Dr. F. L. Hawks.
Uncle Toby,	Rev. Tobias H. Miller.
Veteran Observer,	E. D. Mansfield.
Vigilant,	John Corlett.
Vivian,	George H. Lewes.
Vivian Joyeux,	W. M. Praed.
Walter Maynard,	William Beale.
Warhawk,	William Palmer.
Warrington,	W. P. Robinson.
Warwick,	F. O. Otterson.
Waters,	William H. Russell.
What's His Name,	E. C. Massey.
Wilibald, Alexis,	William Haering.
Wizard,	John Corlett.

NOM DE PLUME.	REAL NAME.
Amy Lothrop,	Miss Anna B. Warner.
American Girl Abroad,	Miss Trafton.
Aunt Kitty,	Maria J. Mackintosh.
Aunt Mary,	Mary A. Lathbury.
Christopher Crowfield,	Mrs. Harriet Beecher Stowe.
Cousin Alice,	Mrs. Alice B. Haven.
Cousin Kate,	Catherine D. Bell.
Charles Egbert Craddock,	Miss Murfree.
Currer Bell,	Charlotte Bronte (Mrs. Nichols.)
Dolores,	Miss Dickson.
E. D. E. N.	Mrs. Emma D. E. N. Southworth.
Eleanor Kirke,	Mrs. Nolly Ames.
Elizabeth Wetherell,	Susan Warner.
Ella Rodman,	Mrs. Eliza Rodman.
Ellis Bell,	Emily J. Bronte.
Fanny Fern,	Mrs. James Parton.
Fanny Fielding,	Mary J. S. Upsher.
Fanny Forester,	Emily C. Judson.
Florence Percy,	Mrs. Elizabeth Akers Allen.
Gail Hamilton,	Miss Mary Abigail Dodge.
George Eliot,	Mrs. Marian Lewes Cross.
George Sand,	Mme. Amantine Lucille Aurore Dudevant.
Grace Greenwood,	Mrs. Sarah J. Lippincott.
Grace Wharton,	A. T. Thompson.
Harriet Myrtle,	Mrs. Lydia F. F. Miller.

NOM DE PLUME.	REAL NAME.
Hesba Stretton,	Miss Hannah Smith.
Howard Glyndon,	Laura C. Redden.
Ianthe,	Emma C. Embury.
Jennie June,	Mrs. Jennie C. Croly.
John Oliver Hobbs,	Mrs. Perry Cragie.
John Strange Winter,	Mrs. Stannard.
Kate Campbell,	Jane Elizabeth Lincoln.
Louise Muhlbach,	Clara Mundt.
Marion Harland,	Mary V. Terhune.
Minnie Myrtle,	Miss Anna C. Johnson.
Mintwood,	Miss Mary A. E. Wager.
Octave Thanet,	Miss Alice French.
Olivia,	Emily Edson Grigg.
Ouida,	Louisa De La Rame.
Patty Lee,	Alice Cary.
Perdita,	Mrs. Mary Robinson.
Saxe Holm,	Miss Rush Ellis.
Shirley Dare,	Mrs. Susan D. Waters.
Sophie May,	Mrs. Eckerson.
Sophie Sparkle,	Jennie E. Hicks.
Straws, Jr.,	Kate Field.
Susan Coolidge,	Miss Woolsey.
Una,	Mary A. Ford,

Great Men's Reading.

Beethoven was fond of history and novels.

Cowper read only his Bible and his prayer-book.

Hallam said that Livy was the model historian.

Chopin rarely read anything heavier than a French novel.

Auber hated reading, and never read save under compulsion.

Cæsar Borgia had a library of works relating mostly to art.

Titian read his prayer-book and the Metamorphoses of Ovid.

Voltaire's favorite classical author was Juvenal, the satirist.

Rossini, for nearly thirty years, read nothing but French novels.

Jean Paul Richter had only five or six books, all philosophical.

Paul Veronese thought there was no book equal to the "Æneid."

Lord Clive said that "Robinson Crusoe" beat any book he ever read.

Franklin read all he could find relating to political economy and finance.

Michael Angelo was fondest of the Books of Moses and the Psalms of David.

Bach was no great reader, but much enjoyed books of jokes and funny stories.

Hogarth was fond of joke-books and farces, and enjoyed them immoderately.

Cherubini was a lover of botany, and made collections of works on the subject

Mario, the great tenor, read anything he could obtain relating to sports or hunting.

George III., for many years of his life, read nothing but his Bible and prayer-book.

"Papa" Hadyn liked stories, and he said, "The more love there is in them the better."

St. John Chrysostom never tired of reading or of praising the works of the Apostle John.

Da Vinci read Pindar, and thought him the noblest poet who ever wrote in any language.

Swift made a special study of the Latin satirists, and imitated their style and language.

Heine seldom read anything but poetry, but he read that with the most scrupulous attention.

Baxter read only the Bible, and best enjoyed the Prophecies of Isaiah and the Psalms.

Wordsworth was fond of the poetry of Burns, but said the latter was too rough and uncouth.

Molière was a reader of romances. His plays give many evidences of his excellent memory.

Wagner was a close student of musical history, and made that line of reading a specialty.

Bulwer-Lytton's favorite author was Horace. He always carried a small edition in his pocket.

Charles II., of England, delighted in Chaucer, and thought him the greatest poet that ever lived.

Carlyle had a very large library, relating principally to German and French literature and history.

Lablache, the stout basso, was a student of botany, and had quite a collection of botanical works.

Tennyson was a close student of the old English tales, and had a large library of such literature.

Landseer was a student of anatomy and zoology, and made collections of books on these subjects.

James I., of England, was a lover of the classics, and very familiar with most of the Latin writers.

Bunyan read little besides his Bible, and often said that Christians would do well to read no other book.

Vandyke, the painter, was fond of the Decameron, and often, in conversation, quoted from its pages.

Bolingbroke was a warm admirer of the French philosophical writers, and had a large collection of their works.

Hannah More made a collection of educational works, and read extensively on the line of female-education.

Cardinal Richelieu once said that Tibullus, the Latin erotic poet, was the most natural of all the ancients.

Louis XIV. thought that Ovid's "Art of Love" was one of the most charming books that had ever been written.

Goethe once said that his literary life was determined by a volume of folk-lore tales he read when a child.

Julius Cæsar was a close student of Homer, and said that all military science was comprised in its pages.

David, the French historical painter, was a student of French history, to the exclusion of almost all other reading.

Salvator Rosa liked any kind of poetry, but more especially that relating to the country or to country scenes.

Mrs. Siddons gave much attention to the history of the drama, and had an extensive library of this kind of matter.

Tolstoi is said to have a large library of sociology, and to read attentively any book bearing on some new social fad.

Addison's specialty was the history of medals and coins, and he eagerly perused anything treating of this subject.

Mendelssohn was a close student of Jewish history and remarkably well informed as to every particular of Jewish annals.

Twelve Greatest Books of the Nineteenth Century.

The following are generally conceded to be the twelve greatest books of the nineteenth century: Darwin's, "Origin of the Species;" Hegel's "Logic," and "Philosophy of Religion;" Goethe's, "Faust;" Emerson's, "Essays;" Harriet Beecher Stowe's, "Uncle Tom's Cabin;" Sir Walter Scott's, "Historical Novels;" William Wordsworth's, "Poems;" Alfred Tennyson's, "In Memoriam;" Victor Hugo's, "Les Miserables;" John Ruskin's, "Modern Painters;" Thomas Carlyle's, "Sartor Resartus;" Strauss', "Life of Jesus."

Newspapers in the United States and the World.

In 1775 there were only twenty-seven newspapers published in the United States. Ten years later, in 1785, there were seven published in the English language in Philadelphia alone, of which one was a daily. The oldest newspaper published in Philadelphia at the time of the Federal convention was the *Pennsylvania Gazette*, established by Samuel Keimer, in 1728. The second newspaper in point of age was the *Pennsylvania Journal*, established in 1742 by William Bradford, whose uncle, Andrew Bradford, established the first newspaper in Pennsylvania, the *American Weekly Mercury*, in 1719. Next in age, but the first in importance, was the *Pennsylvania Packet*, established by John Dunlap in 1771. In 1784 it became a daily, being the first daily newspaper printed on this continent.

Statistics for the Year 1900.

Rowell's "American Newspaper Directory" for 1900 reports the number of newspapers published in the United States and Canada as 21,789. Of these, 924 were Canadian publications. The following was the frequency of issue: Weekly, 15,375; monthly, 2,939; daily, 2,279; semi-monthly, 296; semi-weekly, 470; quarterly, 180; biweekly, 76; bi-monthly, 68; tri-weekly, 52—total, 21,789.

The total number of *newspapers* published in the world at present is estimated at about 50,000, distributed as follows: United States and Canada, 21,789; Germany, 7,000; Great Britain, 9,000; France, 4,300; Japan, 2,000; Italy, 1,500; Austria-Hungary, 1,200; Asia, exclusive of Japan, 1,000; Spain, 850; Russia, 800; Australia, 800; Greece, 600; Switzerland, 450; Holland, 300; Belgium, 300; all others, 1,000. Of these more than half are printed in the English language.

Lubbock's List of the Hundred Best Books.

The Bible.
Confucius, *Analects.*
Aristotle, *Ethics.*
Apostolic Fathers.
Pascal, *Pensées.*
Comté, *Positive Philosophy.*
Jeremy Taylor, *Holy Living.*
Keble, *Christian Year.*
Plato's *Dialogues.*
Demosthenes' *De Corona.*
Horace, *Poems.*
Homer, *Iliad and Odyssey.*
Virgil, *Aeneid.*
Malory, *Morte d'Arthur.*
Haha-Bharata, *Ramayana.*
Æschylus, *Prometheus.*
Sophocles, *Edipus, Trilogy.*
Aristophanes, *The Knights.*
Xenophon, *Anabasis.*
Tacitus, *Germania.*
Gibbon, *Decline and Fall.*
Grote, *Greece.*
Smith, *Wealth of Nations.*
Humboldt, *Travels.*
Shakespeare.
Dante, *Divina Commedia.*
Dryden's *Poems.*
Gray, *Poems.*
Wordsworth, *Poems.*
Pope, *Poems.*
Swift, *Gulliver's Travels.*
Arabian Nights.
Burke, *Political Writings.*
The English Essayists.
Sheridan, *Dramas.*
Smiles, *Self Help.*
George Eliot, *Adam Bede.*
Marcus Aurelius, *Meditations.*
Green, *Short History of England.*
Mill *Logic and Political Economy.*
Descartes, *Discours sur la Methode.*
Lewes, *History of Philosophy.*
Goethe's *Faust and Wilhelm Meister.*
Thackeray, *Vanity Fair and Pendennis.*
Bulwer-Lytton, *Last Days of Pompeii.*
Thomas à Kempis, *Imitation.*
Spinoza, *Tractatus Theologico-Politicus.*
Bunyan, *Pilgrim's Progress.*
Epictetus, *Philosophy.*
(St. Hilaire), Le Bouddha.
Mahomet, *Koran.*
Butler, *Analogy.*
Aristotle, *Politics.*
Lucretius, *Philosophical Poems.*
Plutarch, *Lives.*
Nibelungen Lied.
She-king (*Chinese Odes*).
Firdusi, *Shah-Nameh.*
Trilogy, *or Persae.*
Euripides, *Medea.*
Herodotus, *History.*
Thucydides, *History.*
Livy, *History.*
Hume, *England.*
Bacon, *Novum Organum.*
Darwin, *Origin of Species.*
Locke, *On the Understanding*
Cook, *Voyage.*
Milton, *Paradise Lost.*
Spenser, *Færie Queene.*
Chaucer, *Canterbury Tales.*
Burns, *Poems.*
Scott, *Poems.*
Heine, *Poems and Tales.*
Goldsmith, *Vicar.*
Southey, *Poems.*
Defoe, *Robinson Crusoe.*
Cervantes, *Don Quixote.*
Boswell, *Johnson.*
Moliere, *Dramas.*
Voltaire, *Zadig.*
Carlyle, *Past and Present.*
Kingsley, *Westward Ho!*
Scott, *Novels.*
Kingsley, *Heroes; Water Babies.*
Hawthorne's *Tanglewood Tales.*
Hawthorne's *Wonder Book.*
Kingsley's *Madame How and Lady Why.*
Marryatt, *Japhet in Search of a Father.*
Alice's Adventures in Wonderland.
Lanier, *Boy's King Arthur.*
Love Me Little, Love Me Long.
Irving, *Knickerbocker's New York.*
Cicero, *De Officiis, De Amicitia and De Senectute.*
Carlyle, *French Revolution.*
Berkeley, *Human Knowledge.*
Darwin, *Naturalist in the Beagle.*
White, *Natural History of Selbourne.*
Miss Austen, *Emma, or Pride and Prejudice.*
Dickens, *Pickwick and David Copperfield.*

The Ten Greatest Preachers.

Paul.
Whitefield.
Massillon.
Bossuet.
Luther.
Spurgeon.
Beecher.
Fuller.
Taylor.
Knox.

The Ten Greatest Philosophers.

Aristotle.
Plato.
Seneca.
Bacon.
Locke.
Descartes.
Berkeley.
Hamilton.
Le Comte.
Spencer.

The Ten Greatest Reformers.

Luther.
Wycliffe.
Calvin.
Wesley.
Knox.
John Huss.
Savonarola.
Cranmer.
Melanchthon.
Zwingli.

The Ten Greatest Historians.

Herodotus.
Gibbon.
Hume.
Macaulay.
Brancroft.
Thucycides.
Livy.
Tacitus.
Hallam.
Froude.

The Ten Greatest Poets.

Æschylus.
Homer.
Virgil.
Chaucer.
David.
Tasso.
Dante.
Milton.
Shakespeare
Camoens.

The Ten Greatest Painters.

Michael Angelo.
Raphael.
Titian.
Rubens.
West.
Reynolds.
Da Vinci.
Veronese.
Guido.
Rembrandt.

The Ten Greatest Sculptors.

Phidias.
Praxiteles.
Michael Angelo.
Cellini.
Canova.
Flaxman.
Thorwaldsen.
Donatello.
Powers.
Crawford.

THINGS REMARKABLE AND CURIOUS

The Largest Bell in the world is the great bell of Moscow, at the foot of the Kremlin. Its circumference at the bottom is nearly 68 feet, and its height more than 21 feet. In its stoutest part it is 23 inches thick, and its weight has been computed to be 443,772 pounds. It has never been hung, and was probably cast on the spot where it now stands. A piece of the bell is broken off. The fracture is supposed to have been occasioned by water having been thrown upon it when heated in consequence of the building erected over it being on fire.

The Largest Theatre in the world is the new Opera-house in Paris. It covers nearly three acres of ground; its cubic mass is 4,287,000 feet; it cost about 100,000,000 francs. *The largest suspension bridge* is the one between New York City and Brooklyn; the length of the main span is 1,595 feet 6 inches; the entire length of the bridge is 5,980 feet. *The loftiest active volcano* is Popocatapetl—"smoking mountain"—thirty-five miles southwest of Puebla, Mexico; it is 17,748 feet above the sea-level, and has a crater three miles in circumference, and 1,000 feet deep. *The longest span of wire* in the world is used for a telegraph in India over the River Kistnah. It is more than 6,000 feet in length, and is 1,200 feet high.

The Greatest Fortress from a strategical point of view, is the famous stronghold of Gibraltar. It occupies a rocky peninsula jutting out into the sea, about three miles long and three-quarters of a mile wide. One central rock rises to a height of 1,435 feet above the sea-level. Its northern face is almost perpendicular, while its east side is full of tremendous precipices. On the south it terminates in what is called Europa Point. The west side is less steep than the east, and between its base and the sea is the narrow, almost level span on which the town of Gibraltar is built. The fortress is considered impregnable to military assault. The regular garrison in time of peace numbers about 7,000.

The Biggest Cavern is the Mammoth Cave, in Edmonson County, Kentucky. It is near Green River, about six miles from Cave City, and twenty-eight from Bowling Green. The cave consists of a succession of irregular chambers, some of which are large, situated on different levels. Some of these are traversed by the navigable branches of the subterranean Echo River. Blind fish are found in its waters.

The Longest Tunnel in the world is that of the St. Gothard, on the line of railroad between Lucerne and Milan. The summit of the tunnel is 900 feet below the surface at Andermatt, and 6,600 feet beneath the peak of Kastlehorn, of the St. Gothard group. The tunnel is 26½ feet wide, and is 18 feet 10 inches from the floor to the crown of the arched roof. It is 9½ miles long.

The Biggest Trees in the world are the mammoth trees of California. One of a grove in Tulare County, according to measurements made by members of the State Geological Survey, was shown to be 276 feet in height, 108 feet in circumference at base, and 76 feet at a point 12 feet above ground. Some of the trees are 376 feet high, and 34 feet in diameter. Some of the largest that have been felled indicate an age of from 2,000 to 2,500 years.

The Largest Library is the Bibliotheque National, in Paris, founded by Louis XIV. It contains 1,400,000 volumes, 300,000 pamphlets, 173,000 manuscripts, 300,000 maps and charts, and 150,000 coins and medals. The collection of engravings exceeds 1,300,000, contained in some 10,000 volumes.

The Largest Desert is that of Sahara, a vast region of Northern Africa, extending from the Atlantic Ocean on the west to the valley of the Nile on the east. The length from east to west is about 3,000 miles, its average breadth about 900 miles, its area about 2,000,000 square miles. In summer the heat during the day is excessive, but the nights are often cold.

First Things.

The first steamboat plied the Hudson in 1807.

The first sawmakers' anvil was brought to America in 1819.

The first use of a locomotive in this country was in 1820.

Kerosene was first used for lighting purposes in 1826.

The first horse railroad was built in 1826–7.

The first lucifer match was made in 1829.

The first iron steamship was built in 1830.

The first steel pen was made in 1830.

Omnibuses were introduced in New York in 1830.

Ships were first "copper-bottomed" in 1837.

Envelopes were first used in 1839.

Anæsthetics were discovered in 1844.

The first steel-plate was made in 1830.

The entire Hebrew Bible was printed in 1488.

Gold was first discovered in California in 1848.

Christianity was introduced into Japan in 1549.

First almanac printed by George Von Furback in 1460.

Percussion arms were used in the United States Army in 1830.

The first glass factory in the United States was built in 1780.

The first complete sewing-machine was patented by Elias Howe, Jr., in 1846.

The first temperance society in this country was organized in Saratoga County, N. Y., in March, 1808.

The first daily newspaper appeared in 1702. The first newspaper printed in the United States was published in Boston on September 25, 1790.

The first telegraph instrument was successfully operated by S. F. B. Morse, the inventor, in 1835, though its utility was not demonstrated to the world until 1842.

The first Union flag was unfurled on the 1st of January, 1776, over the camp at Cambridge. It had thirteen stripes of white and red, and retained the English cross in one corner.

When Captain Cook first visited Tahiti, the natives were using nails of wood, bone, shell, and stone. When they saw iron nails, they fancied them to be shoots of some very hard wood, and, desirous of securing such a valuable commodity, they planted them in their gardens.

In 1750 the "shoe-black" came into vogue. The poet Gay, in his day, refers to the business, and describes a mother as instructing her son in this calling.

The 19th Century in a Nutshell.

The Nineteenth century received from its predecessors the horse; we bequeathed the bicycle, the locomotive, and the motor car.

We received the goose quill and bequeathed the typewriter.

We received the scythe and bequeathed the mowing machine.

We received the hand printing press; we bequeathed the cylinder press.

We received the painted canvas; we bequeathed lithography, photography and color photography.

We received the hand-loom; we bequeathed the cotton and woolen factory.

We received gunpowder; we bequeathed lyddite.

We received the tallow dip; we bequeathed the electric lamp.

We received the galvanic battery; we bequeathed the dynamo.

We received the flint-lock; we bequeathed Maxims.

We received the sailing ship; we bequeathed the steamship.

We received the beacon signal fire; we bequeathed the telephone and wireless telegraphy.

We received ordinary light; we bequeathed Roentgen rays.

The Paris Exposition of 1900.

The Paris Universal International Exposition of 1900 was formally declared open by President Loubet April 14, and closed its doors November 12. During its existence 50,000,000 paying visitors passed through its gates. The largest attendance in one day was 600,000. (The number of paying visitors at the Chicago Fair of 1893 was 27,529,000; the largest number of visitors in one day over 700,000.) The French exhibitors at Paris were naturally the most numerous and received the largest number of prizes, but the following is a statement of the awards to the exhibitors of the four foreign nations having the largest representation:

In the electrical department, Group 5, the United States led the world, receiving 94 awards, of which 6 were grand prizes. Germany came next in this section, but received only 49 prizes.

In transportation the United States led, receiving 130 awards, with Germany next, 123 prizes, and Great Britain third, having 119 prizes. There were many surprises when the final awards were made, and none more so than in the Department of Foodstuffs, Group 10, in which Italy surpassed all other nations, with 306 awards. The United States came fifth, with 177 awards.

Nations.	Grand Prix.	Gold.	Silver.	Bronze.	Honorable Mention.	Total Awards.	Total No. Exhibitors.
United States	215	547	593	501	348	2,204	6,916
Germany . .	236	510	575	321	184	1,826	2,689
England . .	183	406	517	410	208	1,727	2,959
Russia . . .	209	346	411	321	206	1,493	2,285

In Group 11, Mining and Metallurgy, the United States surpassed all nations. This American display was a magnificent one, commanding the admiration of every visitor, and the awards were 133, of which 34 were grand prizes.

The jury of final appeal in the matter of prizes to be awarded by the Exposition Management closed its work in September. The statement prepared for the United States committee shows that America received the highest number of awards of any nation save France, and that she also received more awards in each classification, except grand prizes, in which Germany secured 236, against the United States 215. These figures, excepting for France, are shown in above table.

Owners of Land in America.

Nearly 22,000,000 acres of land are owned by men who owe allegiance to other governments. To be exact, there are 21,241,900 acres of land under the direct control and management of thirty foreign individuals or companies. There are 2,720,283 acres of land in Massachusetts, so that the men living in other countries and owing allegiance to other powers own land enough to make about ten States like Massachusetts, more than the whole of New England, more land than some governments own to support a king. The largest amount of land owned by any one man or corporation is by a company called the Holland Land Company. There is twice as much land owned by aliens in the United States as there is owned by Englishmen in Ireland.

Principal Battles of the Civil War. Dates, Commanders, and Number Killed on Both Sides.

Bull Run (first), July 21, 1861—North, General McDowell; killed, 481; South, General Beauregard; killed, 269. *Shiloh*, April 7, 1862—North, General Grant; killed, 1,735; South, General A. S. Johnston; killed, 1,728. *Seven Pines* and *Fair Oaks*, May 31 and June 1, 1862—North, General McClellan; killed, 890; South, General J. E. Johnston; killed, 2,800. *Seven Days*, June 25–July 1, 1862—North, General McClellan; killed 1582; South, General Lee; killed unknown. *Second Bull Run*, August 29–30, 1862—North, General Pope; South, General Lee; no exact estimate. *Antietam*, Sept. 16 and 17, 1862—North, General McClellan; killed, 2,010; South, General Lee; killed, 3,500. *Corinth*, October 3–4, 1862—North, General Rosecrans; killed, 315; South, General Van Dorn; killed, 1,423. *Perryville*, October 8, 1862—North, General Buell; killed, 820; South, General Bragg; killed, 1,300. *Fredericksburg*, December 11–15, 1862—North, General Burnside; killed, 1128; South, General Lee; killed, 1,200. *Murfreesboro*, December 31, 1862, January 1, 1863—North, General Rosecrans; killed, 1,474; South, General Johnston; killed, unknown. *Chancellorville*, May 2 and 3, 1863—North, General Hooker; killed, 1,512; South, General Lee; killed, 1,581. *Gettysburg*, July 1, 2 and 3, 1863—North, General Meade; killed, 2,834; South, General Lee; killed, 3,500. *Vicksburg*, July 3 and 4, 1863—North, General Grant; killed, 545; South, General Pemberton; killed, unknown. *Chickamauga*, Sept. 19–23, 1863—North, General Thomas; killed, 1,644; South, General Bragg; killed, 2,389. *Lookout Mountain and Missionary Ridge*, November 23–25, 1863—North, General Grant; total loss, 4,000; South, General Bragg; total loss, 4,000. *Wilderness*, May 5–7, 1864—North, General Grant; killed, unknown; South, General Lee; killed, unknown. *Spottsylvania*, May 8–18, 1864—North, General Grant; killed, 2,261; South, General Lee; killed, unknown. *Cold Harbor*, June 1, 1864—North, General Grant; total loss, 10,000; South, General Lee; total loss, 8,000. *Franklin*, November 30, 1864—North, General Schofield; killed 189; South, General Hood; killed 1750. *Nashville*, December 1–14, 1864—North, General Thomas; total loss, 6,500; South, General Hood; total loss, 23,000. *Five Forks*, April 1, 1865; North, General Grant; total loss, 7,000; South, General Lee; total loss, 15,000.

Growth of the United States.

This country began the present century with 5,308,483 people. In the year 1810 the population was 7,239,881, an increase of 36.28 per cent.; in 1820 it was 9,633,822, an increase of 33.66 per cent.; in 1830 it was 12,866,020, an increase of 32.51 per cent.; in 1840 it was 17,069,453, an increase of 32.52 per cent.; in 1850 it was 23,191,876, an increase of 35.83 per cent.; in 1860 it was 31,443,321, an increase of 35.11 per cent.; in 1870 it was 38,558,371, an increase of 22.65 per cent.; in 1880 it was 50,154,783, an increase of 30.08 per cent.; in 1890 it was 62,622,250, an increase of about 28 per cent.; in 1900 it was 76,295,220. This is exclusive of the islands of Porto Rico, the Hawaiian and the Phillippine islands, which bring about 10,000,000 more people under our dominions.

This great growth is shown by a few comparisons. The British Islands began the present century with three times as many people as the United States, and yet its present population is less than three-fifths of our own. Of all the civilized countries, Russia has the most people, but at our rate of increase it will not be many years before this country passes Russia. Another interesting fact is that the English language is spreading twice as rapidly as any other tongue, so that the future promises to the United States not only leadership in population, but in the language of the world.

In this connection it will be interesting to compare and note

How the Great Powers Have Changed Rank in 100 Years.

The change of the seats of power will be seen by a comparison of the relative populations of 1800 and 1900.

In 1800 the great powers of the world were thus grouped:

Russia	38,140,000
France	27,720,000
Germany	22,330,000
Austria	21,230,000
United Kingdom	15,570,000

Italy	13,380,000
Spain	10,440,000
United States	5,310,000

In the year 1900 we have the following figures:

Russia	130,896,628
United States	76,295,220
Germany	53,000,000
Austria-Hungary	42,660,906
United Kingdom	49,559,954
France	38,517,975
Italy	31,000,000
Spain	18,250,000

Of this population the English-speaking races in Great Britain and Ireland, with the English-speaking colonies, and the United States, number 130,000 000, offsetting Russia's 130,896,628.

Politics of the Presidents.

The subjoined table will be found interesting as a reference to many of our readers. Of course, the name of Washington heading the list does not mean that he was the candidate of any party or faction, but is placed there to complete the roll:

Name.	Inauguration.	Politics.
George Washington	April 30, 1789	Unanimous.
John Adams	March 4, 1797	Federal.
Thomas Jefferson	March 4, 1801	Democrat.
James Madison	March 4, 1809	Democrat.
James Monroe	March 4, 1817	Democrat.
John Quincy Adams	March 4, 1825	Compromise
Andrew Jackson	March 4, 1829	Democrat.
Martin Van Buren	March 4, 1837	Democrat.
William H. Harrison	March 4, 1841	Whig.
John Tyler	April 6, 1841	Whig.
James K. Polk	March 4, 1845	Democrat.
Zachary Taylor	March 5, 1849	Whig.
Millard Fillmore	July 9, 1850	Whig.
Franklin Pierce	March 4, 1853	Democrat.
James Buchanan	March 4, 1857	Democrat.
Abraham Lincoln	March 4, 1861	Republican.
Andrew Johnson	April 15, 1865	Republican.
U. S. Grant	March 4, 1869	Republican.
R. B. Hayes	March 5, 1877	Republican.
James A. Garfield	March 4, 1881	Republican.
Chester A. Arthur	Sept. 20, 1881	Republican.
Grover Cleveland	March 4, 1885	Democrat.
Benj. Harrison	March 4, 1889	Republican.
Grover Cleveland	March 4, 1893	Democrat.
William McKinley	March 4, 1897	Republican.
William McKinley	March 4, 1901	Republican.

Education of Presidents.

Washington—Fair English education.
Adams—Harvard College.
Jefferson—William and Mary.
Madison—Princeton College.
Adams, J. Q.—Harvard College.
Jackson—Limited education.
Van Buren—Academic course.
Harrison, W. H.—Hampden College.
Tyler—William and Mary.
Polk—University of North Carolina.
Taylor—Slight, the rudiments.
Fillmore—Limited education.
Pierce—Bowdoin College.
Buchanan—Dickinson College.
Lincoln—Education limited.
Johnson—Self-educated.
Grant—West Point.
Hayes—Kenyon College.
Garfield—Williams College.
Arthur—Union College.
Cleveland—Hamilton College.
Benj. Harrison—Miami University.
McKinley—Allegheny College.

Religion of the Presidents.

Washington, Garfield, and Harrison were the only Presidents who were church members, but all, one excepted, were men who revered Christianity. Adams married a minister's daughter, and was inclined to Unitarianism. Jefferson was not a believer, at least while he was Chief Magistrate. Madison's early connections were Presbyterian. Monroe is said to have favored the Episcopal Church. John Quincy Adams was like his father. Jackson was a Presbyterian and died in the communion of that church. Van Buren was brought up in the Reformed Dutch Church, but afterward inclined to the Episcopal Church. Harrison leaned toward the Methodist Church, and Tyler was an Episcopalian. Polk was baptized by a Methodist preacher after his term of office expired. Taylor was inclined to the Episcopal communion. Fillmore attended the Unitarian Church, and Franklin Pierce was a member, but not a communicant, of a Congregational Church at Concord. Buchanan was a Presbyterian, as was also Benjamin Harrison. General Grant attended the Methodist Church, and President Garfield the Church of the Disciples. Cleveland, the son of a Presbyterian minister, remained in that faith, while McKinley, from boyhood, was an active worker in the Methodist Church.

Cabinet Facts of Interest.

There were six Secretaries of State who afterward became Presidents, namely, Jefferson, Madison, Monroe, John Quincy Adams, Van Buren, and Buchanan. Monroe was Secretary of War for a short time after he had served in the State Department, and General Grant was Secretary of War *ad interim*. There have been no Secretaries of the Treasury, the Navy, or the Interior, nor any Postmasters or Attorney-Generals who have become President. Jeff Davis was Secretary of War under President Pierce.

Salaries of United States Officers, Per Annum.

PRESIDENT, VICE-PRESIDENT AND CABINET.—President, $50,000; Vice-President, $8,000; Cabinet Officers, $8,000 each.

UNITED STATES SENATORS. — $5,000 with mileage.

CONGRESS.--Members of Congress, $5,000 with mileage.

SUPREME COURT.—Chief Justice, $10-500; Associate Justices, $10,000.

CIRCUIT COURTS.—Justices of Circuit Courts, $6,000.

HEADS OF DEPARTMENTS.—Supt. of Bureau of Engraving and Printing, $4,500; public printer $4,500; Supt. of Census, $6,000; Supt. of Naval Observatory, $5,000; Supt. of the Signal Service, $4,000; Director of Geological Surveys, $6,000; Director of the Mint, $4,500; Commissioner of General Land Office, $4,000; Commissioner of Pensions, $5,000; Commissioner of Labor, $5000; Commissioner of Indian Affairs, $4 000; Commissioner of Education, $3,000; Commander of Marine Corps, $3,500; Supt. of Coast and Geodetic Survey, $6,000.

UNITED STATES TREASURY.—Treasurer, $6,000; Register of Treasury, $4,000; Comptroller of Customs, $4,000.

POST-OFFICE DEPARTMENT Washington. — Four Assistant Postmaster-Generals, $4,000; Chief Clerk, $2,500.

POSTMASTERS.—Postmasters are divided into four classes. First class, $3,000 to $4,000 (excepting New York City, which is $8,000); second class, $2,000 to $3,000; third class, $1,000 to $2,000; fourth class less than $1,000. The first three classes are appointed by the President, and confirmed by the Senate; those of fourth class are appointed by the Postmaster-General.

DIPLOMATIC APPOINTMENTS. — *Ambassadors*, at $17,500, to France, Great Britain, Germany, Mexico and Russia. *Envoys Extraordinary and Ministers Plenipotentiary*, at $12,000; to Austria-Hungary, Brazil, China, Italy, Japan and Spain; at $10,000 to Argentine Republic, Belgium, Chili, Columbia, Guatemala, Nicaragua, Peru, Netherlands, Turkey and Venezuela; at $7,500: to Denmark, Hayti, Paraguay and Uruguay, Portugal, Sweden and Norway, Switzerland; at $5,000: to Bolivia, Ecquador; at $6,500: to Greece. *Ministers Resident* at $7,500: Corea and Siam; at $5,000: Persia. Then four Consuls-Generals at $6,000, three at $5,000, six at $4,000, and eight at $3,500 to $2,000; also seventy-two Consuls at $1,000 up to $3,500.

ARMY OFFICERS.— General, $13,500; Lieut.-General, $11,000; Major-General, $7,500; Brigadier-General, $5,500; Colonel, $3,500; Lieut.-Colonel, $3,000; Major, $2,500; Captain, mounted, $2,000; Captain, not mounted, $1,800; Regimental Adjutant, $1,800; Regimental Quartermaster, $1,800; First Lieutenant, mounted, $1,600; First Lieutenant, not mounted, $1,500; Second Lieutenant, mounted, $1,500; Second Lieutenant, not mounted, $1,400; Chaplain, $1,500.

NAVY OFFICERS. — Admiral, $13,500; Vice-Admiral, $9,000; Rear-Admirals, $6,000; Commodores, $5,000; Captains, $4,500; Commanders, $3,500; Lieut.-Commanders, $2,800; Lieutenants, $2,400; Masters, $1,800; Ensigns, $1,200; Midshipmen, $1,000; Cadet Midshipmen, $500; Mates, $900; Medical and Pay Directors and Medical and Pay Inspectors and Chief Engineers, $4,400; Fleet Surgeons, Fleet Paymasters, and Fleet Engineers, $4,400; Surgeons and Paymasters, $2,800; Chaplains, $2,500.

Popular and Electoral Votes for Presidents.

YEAR	CANDIDATES	PARTY	Popular Vote	Elec'l Vote
1832	Andrew Jackson	Democrat	687,502	219
1832	Henry Clay	Nat. Republican	530,189	49
1832	John Floyd	Whig		11
1832	William Wirt	Whig		7
1836	Martin Van Buren	Democrat	761,549	170
1836	W. H Harrison	Whig	736,656	73
1836	Hugh L. White	Whig		26
1836	Daniel Webster	Whig		14
1836	W. P. Mangum	Whig		11
1840	Martin Van Buren	Democrat	1,128,702	48
1840	W. H. Harrison	Whig	1,275,017	234

YEAR	CANDIDATES	PARTY	Popular Vote	Elec'l Vote
1844	James K. Polk	Democrat	[illegible]	170
1844	Henry Clay	Whig	[illegible]	105
1848	Zachary Taylor	Whig	[illegible]	163
1848	Lewis Cass	Democrat	[illegible]	127
1848	Martin Van Buren	Free Soil	[illegible]	..
1852	Franklin Pierce	Democrat	[illegible]	254
1852	Winfield Scott	Whig	[illegible]	42
1852	John P. Hale	Free Soil	[illegible]	....
1856	James Buchanan	Democrat	[illegible]	174
1856	John C. Fremont	Republican	[illegible]	114
1856	Millard Fillmore	American	[illegible]	8
1860	Abraham Lincoln	Republican	[illegible]	180
1860	Stephen A. Douglas	Democrat	[illegible]	12
1860	John C. Breckinridge	Democrat	[illegible]	72
1860	John Bell	Union	[illegible]	39
1864	Abraham Lincoln	Republican	[illegible]	212
1864	George B. McClellan	Democrat	[illegible]	21
1868	U. S. Grant	Republican	[illegible]	214
1868	Horatio Seymour	Democrat	[illegible]	80
1872	U. S. Grant	Republican	[illegible]	286
1872	Horace Greeley	Liberal and Dem.	[illegible]	
1872	James Black	Prohibition	5,608	......
1876	R. B. Hayes	Republican	[illegible]	185
1876	Samuel J. Tilden	Democrat	[illegible]	184
1876	Peter Cooper	Greenback	[illegible]	..
1876	G. C. Smith	Prohibition	[illegible]	.
1880	James A. Garfield	Republican	[illegible]	214
1880	Winfield S. Hancock	Democrat	[illegible]	155
1880	James B. Weaver	Greenback	[illegible]	..
1884	Grover Cleveland	Democrat	[illegible]	219
1884	James G. Blaine	Republican	[illegible]	182
1884	Benj. F. Butler	Greenback	[illegible]	....
1884	John P. St. John	Prohibition	[illegible]	..
1888	Benjamin Harrison	Republican	[illegible]	233
1888	Grover Cleveland	Democrat	[illegible]	168
1888	Fisk	Prohibition	[illegible]	......
1888	Labor Vote		[illegible]	..
1892	Grover Cleveland	Democrat	[illegible]	277
1892	Benjamin Harrison	Republican	[illegible]	145
1892	James B. Weaver	People's	1,030,1[illegible]	22
1892	John Bidwell	Prohibitory	268,361	......
1896	Wm. McKinley	Republican	7,1[illegible]	271
1896	Wm. Jennings Bryan	Democrat	[illegible]	176
1896	John M. Palmer	Gold Democrat	132,056	......
1896	Joshua Levering	Prohibition	127,174	......
1896	C. H. Matchett	Socialist-Labor	36,426	...
1900	Wm. McKinley	Republican	[illegible]	292
1900	Wm. Jennings Bryan	Democrat	[illegible]	155

Eleven Great Wonders in America.

Croton Aqueduct, in New York City.

City Park, Philadelphia, Pennsylvania. The largest park in the world.

Lake Superior. The largest lake in the world.

Mammoth Cave, in Kentucky.

Niagara Falls. A sheet of water three-quarters of a mile wide, with a fall of 175 feet.

Natural Bridge, over Cedar Creek, in Virginia.

New State Capitol, at Albany, N. Y.

New York and Brooklyn Bridge.

The Central Park, in New York City.

Washington Monument, Washington, D. C., 555 feet high.

Yosemite Valley, California; fifty-seven miles from Coulterville. A valley from eight to ten miles long, and about one mile wide. Has very steep slopes about 3,500 feet high; has a perpendicular precipice 3,089 feet high; a rock almost perpendicular, 3,270 feet high; and waterfalls from 700 to 1,000.

Noted American Trees.

The big tree of California.

"Old Liberty Elm," at Boston.

"The Burgoyne Elm," at Albany, N. Y.

The immense ash trees planted by General Washington at Mount Vernon, and now the admiration of visitors.

The weeping-willow over the grave of Cotton Mather in Cop's burying-ground, near Bunker Hill, taken from a tree that shaded the grave of Napoleon at St. Helena.

The Cary tree, planted by the roadside in 1832 by Alice and Phœbe Cary, is a large sycamore, standing on the turnpike from College Hill to Mount Pleasant, Hamilton County, Ohio.

The Washington elm still stands at Cambridge, Mass. It is on Garden street, a short distance from the colleges, and is a large, well-preserved tree. An iron fence is built around it, and on a stone in front is the following inscription: "Under this tree George Washington took command of the American Army, July 3, 1775."

The Great Famines of History.

Walford mentions 160 famines since the 11th century, namely: England, 57; Ireland, 34; Scotland, 12; France, 10; Germany, 11; Italy, etc., 36. The worst in modern times have been:

Country.	Date.	No. of Victims.
France	1770	48,000
Ireland	1847	1,029,000
India	1866	1,450,000

Deaths from hunger and want were recorded as follows in 1879, according to Mulhall: Ireland, 3,789; England, 312; London, 101; France, 260. The proportion per 1,000 deaths was, respectively, 37.6, .6, 1.2, .3.

Remarkable Plagues of Modern Times.

Date.	Place.	Deaths.	Weeks.	Deaths per Week.
1656	Naples	380,000	28	13,600
1665	London	68,800	33	2,100
1720	Marseilles	39,100	36	1,100
1771	Moscow	87,800	32	2,700
1778	Constantinople	170,000	18	9,500
1798	Cairo	88,000	25	3,500
1812	Constantinople	144,000	13	11,100
1834	Cairo	57,000	18	3,200
1835	Alexandria	14,900	17	900
1871	Buenos Ayres	26,300	11	2,400

Great Financial Panics.

The most remarkable crises since the beginning of the present century have been as follows:

1814. England, 240 banks suspended.
1825. Manchester, failures 2 millions.
1831. Calcutta, failures 15 millions.
1837. United States, "Wild-cat" crisis; all banks closed.
1839. Bank of England saved by Bank of France. Severe also in France, where 93 companies failed for 6 millions.
1844. England. State loans to merchants. Bank of England reformed.
1847. England, failures 20 millions; discount 13 per cent.
1857. United States, 7,200 houses failed for 111 millions.
1866. London, Overend-Gurney crisis; failures exceeded 100 millions.
1869. Black Friday in New York (Wall street), September 24th.
1873. Many banks failed, and great commercial enterprises where driven to the wall in the United States.
1893–95. The money question of a silver and gold, or the single gold standard was greatly agitated, and the United States passed through a financial crisis which wrecked thousands of business firms and brought on a disastrous financial stringency.

The Greatest Floods in History.

The Thames destroyed a great number of the inhabitants of its banks, nine years after Christ; another which destroyed all the inhabitants in Ferne Island, seven miles southwest from Holy Island, 323; 5,000 people lost in Cheshire by an eruption, 353; another of the Dee which drowned forty families, 415; an inundation of the sea in Norfolk, Suffolk, and Essex, 575; an inundation at Edinburgh, which did great damage, 730; an inundation at Glasgow, which drowned above 400 families, 738; an inundation of the Tweed, which did immense damage, 836; an inundation of the Medway, 861; an inundation at Southampton, which destroyed many people, 935; an inundation of the Severn, which drowned hundreds of cattle, 1046; the sea overflowed 4,000 acres of Earl Godwin's land, in Kent, since called Godwin Sands, 1100; a great part of Flanders overflowed by the sea, 1108; an inundation of the Thames for above six miles at Lambeth, 1243; another, since named the Dollert Sea, 1277; at Winchelsea 300 houses were overthrown by the sea, 1280; 120 laymen, and several priests, besides women, were drowned by an inundation at Newcastle-upon-Tyne, 1339; at the Texel, which first raised the commerce of Amsterdam, 1400; the sea broke in at Dort, and drowned 72 villages and 100,000 people, and formed the Zuyder Sea, 1421; in 1530 the Holland dykes broke, 400,000 lost; in February, 1735, at Dagenham, and upon the coast of Essex, which carried away the sea walls, and drowned several thousand sheep and black cattle; in Spain, and did 3,000,000 livres damage, at Bilboa, April, 1762; at Naples, where it carried away a whole village, and drowned 200 of the inhabitants, November 10, 1773; in Spain, Navarre, September, 1787, where 2,000 lost their lives, all the buildings of several villages carried away by the currents from the mountains; a terrible inundation by the Liffey, in Ireland, which did very considerable damage in Dublin and its environs, November 12, 1787; at Kirkwald, in Scotland, by breaking the Dam-dykes, October 4, 1788, which nearly destroyed the town; almost throughout England by the melting of the snow, and the greater part of the bridges were either destroyed or damaged, February, 1795; at St. Domingo, which destroyed 1,400 persons, October, 1800; on the coast of Holland and Germany, November, 1801; in Dublin and parts adjacent, December 2 and 3, 1802

The Johnstown Flood, in June, 1889, at Johnstown, Pa., was caused by the breaking of a dam on the upper waters of the Conemaugh River, which confined a great lake on top of the Alleghany Mountains. The flood swept down the valley faster than a railroad train in speed. Several small towns and the city of Johnstown were swept away, and 6,111 persons perished.

The Galveston Flood.—In September, 1900, a hurricane along the southern coast of the United States reached the climax of its fury near Galveston, Texas, at 1 o'clock at night, literally blowing the Gulf waters over the island on which Galveston is situated, causing a loss of life and property unparalleled by any similar disaster in the United States. The city of Galveston was well-nigh annihilated, 7,000 lives being lost, and $30,000,000 worth of property destroyed in the city and near by on the mainland. This appears the more frightful in view of the fact that less than 40,000 souls inhabited Galveston. Thousands escaped by clinging to the wreckage of houses and ships which the wind blew far inland on the high tide. About $1,000,000 was subscribed for relief throughout the country, and the rebuilding of the city was begun promptly after the ruins were sufficiently cleared away.

The Greatest World's Fairs.

WHERE HELD	Year.	Area Covered.*	Exhibitors.	Visitors.†	Days Open.	Receipts.
		Acres				
London	1851	21	13,937	6,039,195	141	$1,750,000
Paris	1855	24½	20,839	5,162,330	200	644,100
London	1862	23½	28,653	6,211,103	171	1,644,200
Paris	1867	37	50,226	8,805,969	217	2,103,675
Vienna	1873	40	70,000	6,740,500	186	1,032,385
Philadelphia	1876	60	30,864	10,164,489	159	3,813,724
Paris	1878	60	40,366	16,032,725	194	2,531,650
Sydney	1879	[illegible]	9,345	1,117,536	[illegible]	200,000
Melbourne	1880	.....	....	1,330,279	[illegible]	....
Fisheries Exhibition, London	1883	9	2,000	2,703,051	147	785,000
Health Exhibition, London	1884	....	....	4,153,390	151	892,545
Inventions Exhibition, London	1885	....	....	3,760,581	163	750.000
Colonial and Indian, London	1886	13	.....	5,550,745	164	1,025,000
Glasgow	1888			5,748,379	164	[illegible]
Paris	1889	75¼	55,000	28,149,353	185	8,300,000
Chicago	1893	633	...	27,529,721	183	14,000,000
Paris	1900	.....	75,531	50,000,000	212	....

* Buildings and covered structures.

† The largest number of visitors in any one day was 400,000 in 1889 in Paris, and 716,881 in Chicago in 1893, and [illegible] in Paris in 1900. It will be noticed that the Paris Exposition of 1900 admitted the largest number of paying visitors—50,000,000—ever attending any exposition, almost doubling the total number of paying visitors attending the Chicago Exposition.

The Highest Buildings, Monuments, etc.

	Feet.
Eiffel Tower, Paris	989
Washington Monument	555
City Hall, Philadelphia, Pa.	548
Pyramid, Cheops, Egypt	543
Cathedral, Cologne	511
" Antwerp	476
" Strassburg	474
Tower, Utrecht	464
Steeple, St. Stephen's, Vienna	460
Pyramid, Khafras, Egypt	456
St. Martin's Church, Bavaria	456
Chimney, Port Dundas, Glasgow	454
St. Peter's, Rome	448
Notre Dame, Amiens	422
Salisbury Spire, England	406
Cathedral, Florence	380
" Cremona	372
" Freiburg	367
St. Paul's, London	365
Cathedral, Seville	360
Pyramid, Sakkarah, Egypt	356
Cathedral, Milan	355
Notre Dame, Munich	348
Invalides, Paris	347
Parliament House, London	340
Cathedral, Magdeburg	337
St. Patrick's New York	328
St. Mark's, Venice	328
Statue of Liberty, New York	321
Cathedral, Bologna	306
" Norwich, Eng.	309
" Chichester, Eng.	300
" Lincoln, Eng.	300
St. James' Cathedral, Toronto	316
Capitol, Washington	300
Trinity Church, New York	283
Cathedral, Mexico	280
" Montreal	280
Campanile Tower, Florence	276
Column, Delhi	260
Cathedral, Dantzic	250
Porcelain Tower, Nankin	248
Custom House, St. Louis	240
Canterbury Tower, England	235
Notre Dame, Paris	232
Chicago Board of Trade	230
St. Patrick's, Dublin	226
Cathedral, Glasgow	225
Bunker Hill Monument	220
Notre Dame, Montreal	220
Cathedral, Lima	220
" Rheims	220
" Garden City, L. I.	219
St. Peter and Paul, Philadelphia, Pa.	210
Washington Monument, Baltimore	210

Famous Giants and Dwarfs.

The most noted giants of ancient and modern times are as follows:

Name.	Place.	Height, Feet.	Period.
Goliath	Palestine	11.0	B. C. 1063.
Gabara	Rome	9.9	Claudius Cæsar.
John Middleton,	England	9.3	A. D. 1578.

Name	Place.	Height, Feet.	Period.
Frederick Swede,	Sweden	8.4	. . . .
Cajanus	Finland .	7.9	. . . .
Gilly	Tyrol . .	8.1	. . . .
Patrick Cotter .	Cork . .	8.7	1806.
Chang Gow . .	Pekin . .	7.8	1880.

Many of the great men of history have been rather small in stature. Napoleon was only about five feet four inches, Washington was five feet seven inches. One of the greatest of American statesmen, Alexander H. Stephens, never excelled 115 pounds in weight, and in his old age his weight was less than 100 pounds.

The more notable human mites are named below:

Name.	Height, inches.	Date of Birth.	Place of Birth.
Count Borowlaski	39	1739	Warsaw.
Tom Thumb (Chas. S. Stratton) . . .	31	1837	New York.
Mrs. Tom Thumb .	32	1842	"
Che-Mah	25	1838	China.
Lucia Zarate . . .	20	1863	Mexico.
General Mite . . .	21	1864	New York.

Remarkable Genius in Youth.

Handel had produced an opera before he was fifteen.

Corneille had planned a tragedy before he was ten.

Auber wrote an operetta for the stage before he was fourteen.

Pitt was Chancellor of the Exchequer before he was twenty-five.

Schiller was widely known as a poet before the age of twenty.

Kaulbach at seventeen was pronounced the first artistic genius in Germany.

Kant began his philosophical and metaphysical speculations before the age of eighteen.

Goethe had produced a considerable number of poems and several dramas before he was twenty.

Raphael showed his artistic abilities at the early age of twelve, when he was widely known as an artist in oil.

Remarkable Memories.

Magliabechi, of Florence, called "The Universal Index and Living Cyclopædia" (1633–1714).

P. J. Beronicius, the Greek and Latin improvisator, who knew by heart Horace, Virgil, Cicero, Juvenal, both the Plinys, Homer, and Aristophanes. He died at Middleburgh, in 1676.

Andrew Fuller, after hearing 500 lines twice, could repeat them without a mistake. He could also repeat *verbatim* a sermon or speech; could tell either backward or forward every shop sign from the Temple to the extreme end of Cheapside, and the articles displayed in each of the shops.

Woodfall could carry in his head a debate, and repeat it a fortnight afterward.

Thompson could repeat the names, trades, and particulars of every shop from Ludgate Hill to Piccadilly.

William Radcliff, the husband of the novelist, could repeat a debate the next morning.

Blind Tom, the famous negro pianist, could repeat any speech he heard uttered. He could also play any piece of music from memory after once hearing it. In some respects his mind was very weak.

At the Palmer House, Chicago, is a colored man who stands at the door of the dining-room and receives the hats, coats, and umbrellas of the hundreds of guests who go in to each meal. As they come out, he, without error, hands each guest the articles intrusted to him on entering. In many years' service it is declared he has not made a dozen errors. In view of the fact that he gives no checks, but depends entirely on his memory of faces, and must associate the articles with the individual leaving them, and that he must thus deal with hundreds of strangers every day, and has kept it up daily for many years, his feat of memory is one of the most remarkable on record.

---

*Note.—The 32 half-tone engravings which are printed on plate paper in this book, but not numbered, added to this last page folioed make the total number of pages in this book over 500.

datacolor
0 inch
1
2
3
4
5
6
7
WESTCOTT®
30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12